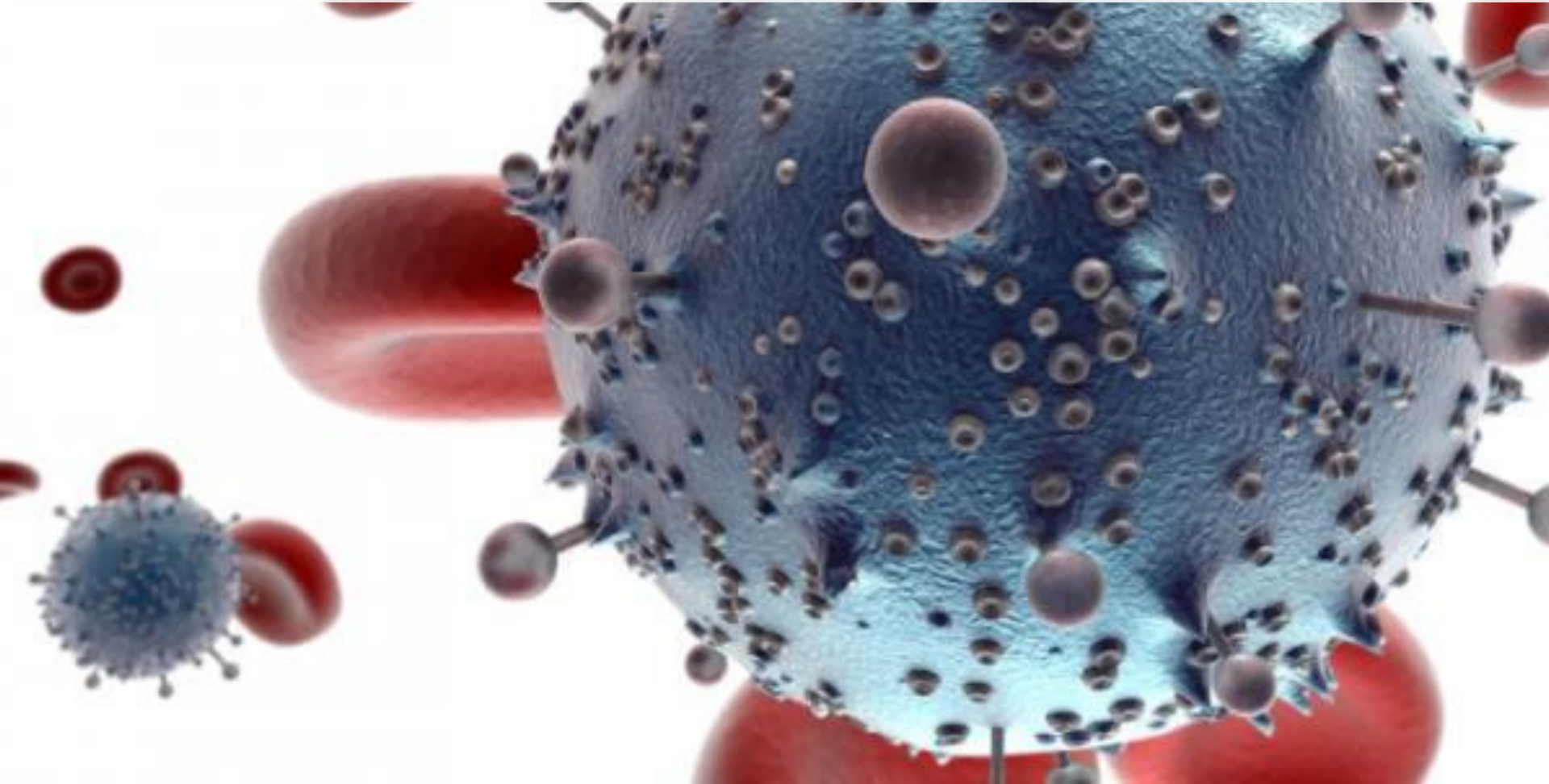
Cambridge Assessment International Education

AS Level
Chapter 10

Infectious Diseases



Chapter Outline

- What is an **infectious disease**? What are **pathogens**?

- Causes, Transmission, Symptoms, Treatment, Prevention and Global Distribution of:

1. **Cholera**
2. **Malaria**
3. **HIV/AIDS**
4. **Tuberculosis**
5. **Smallpox** (just the causative agent)

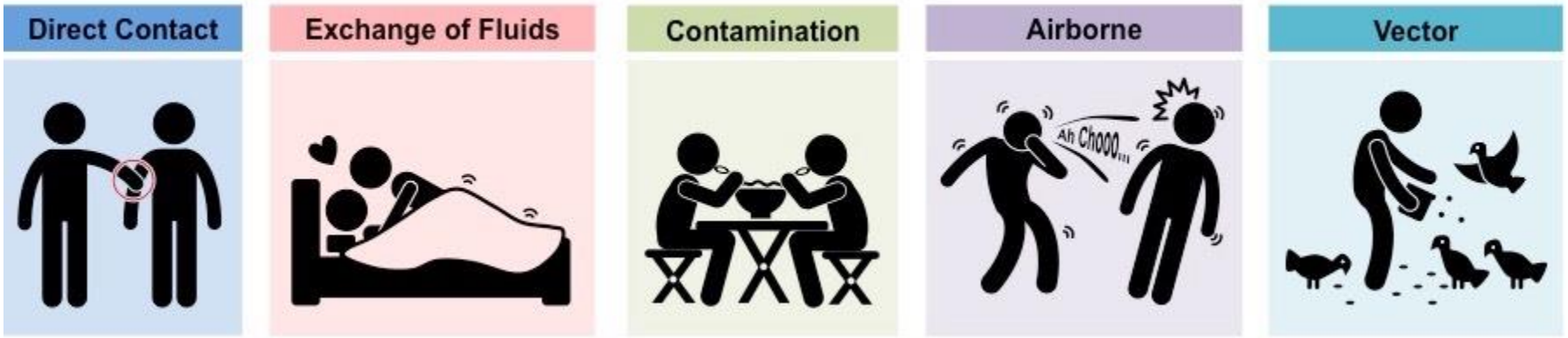
- **Antibiotics**
  e.g. Penicillin
  Why it doesn't it work on viruses?
- **Antibiotic Resistance** (Cause + Consequence + Prevention)

What is a disease?

- **Ill-health / sickness**
- Cause **reduced effectiveness of functions**
- Illness with a set of symptoms
- Poor physical, mental or social well being

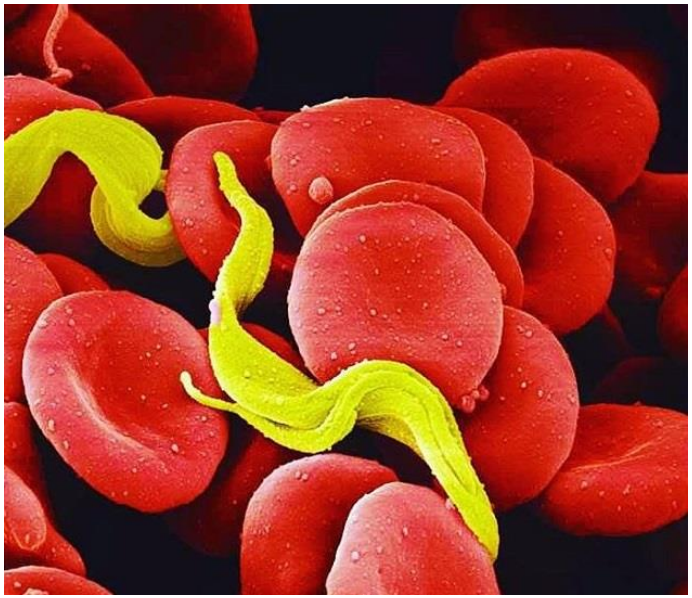
What is an infectious disease?

- Disease caused by a **pathogen**
- Cause harm to health of host
- **Can be passed** from one organism to another
  i.e. communicable / transmissable



What are pathogens?

- **Pathogens** = Parasitic disease-causing microorganisms
- **Can be prokaryote/eukaryotes**
- **E.g. bacteria, virus, protoctists, fungi**



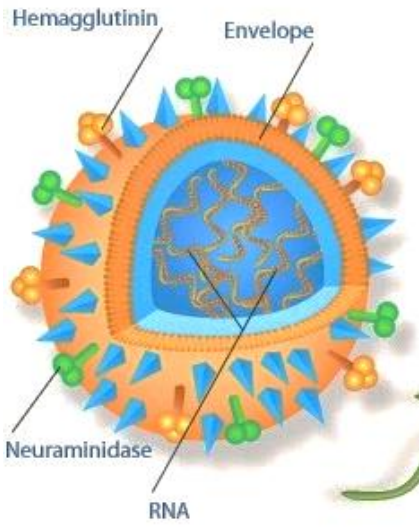
Pathogens….

1) Gain entry to host
2) Colonise host tissue
3) Damage host's tissues
4) Resist host defences

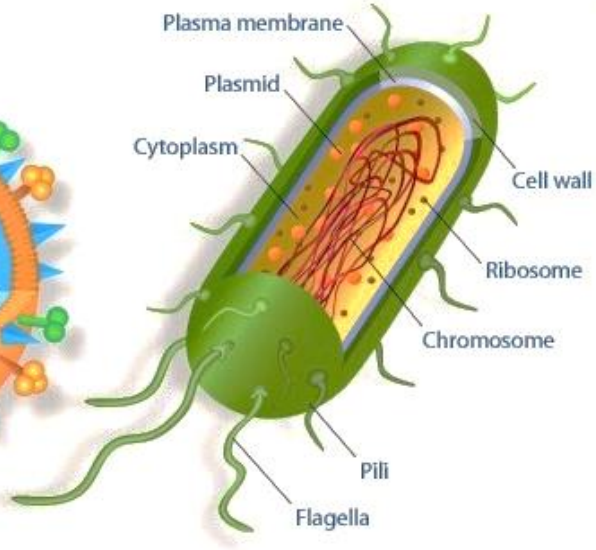
- We need to **break the disease transmission cycle** to prevent disease from spreading

Types of Pathogens

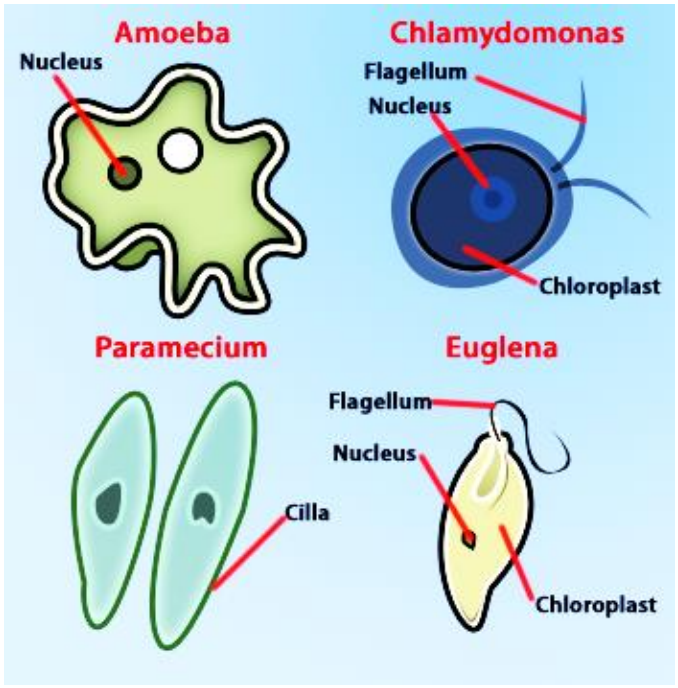
Virus
Non-living



Bacteria
Prokaryote



Protoctist (or protist)
Mostly unicellular eukaryotes



Examples of protists that you may know (they do not cause disease and are not pathogens though!)

Fungi
Eukaryotes

Viruses

- **Non-cellular** structure
- No plasma membrane, cytoplasm, ribosomes

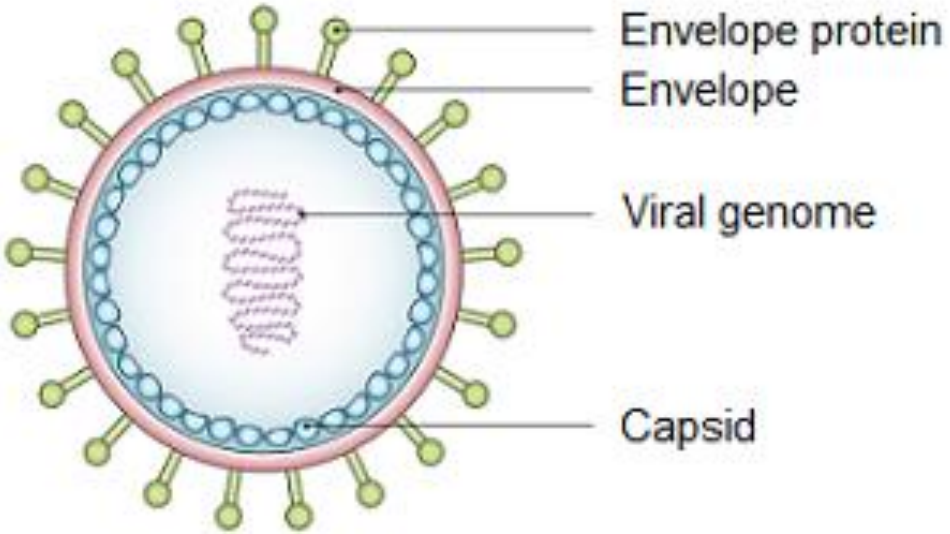
- Only:

1. **DNA or RNA**
2. Protein coat = **capsid**

- Protective coat
- May have one or two coats

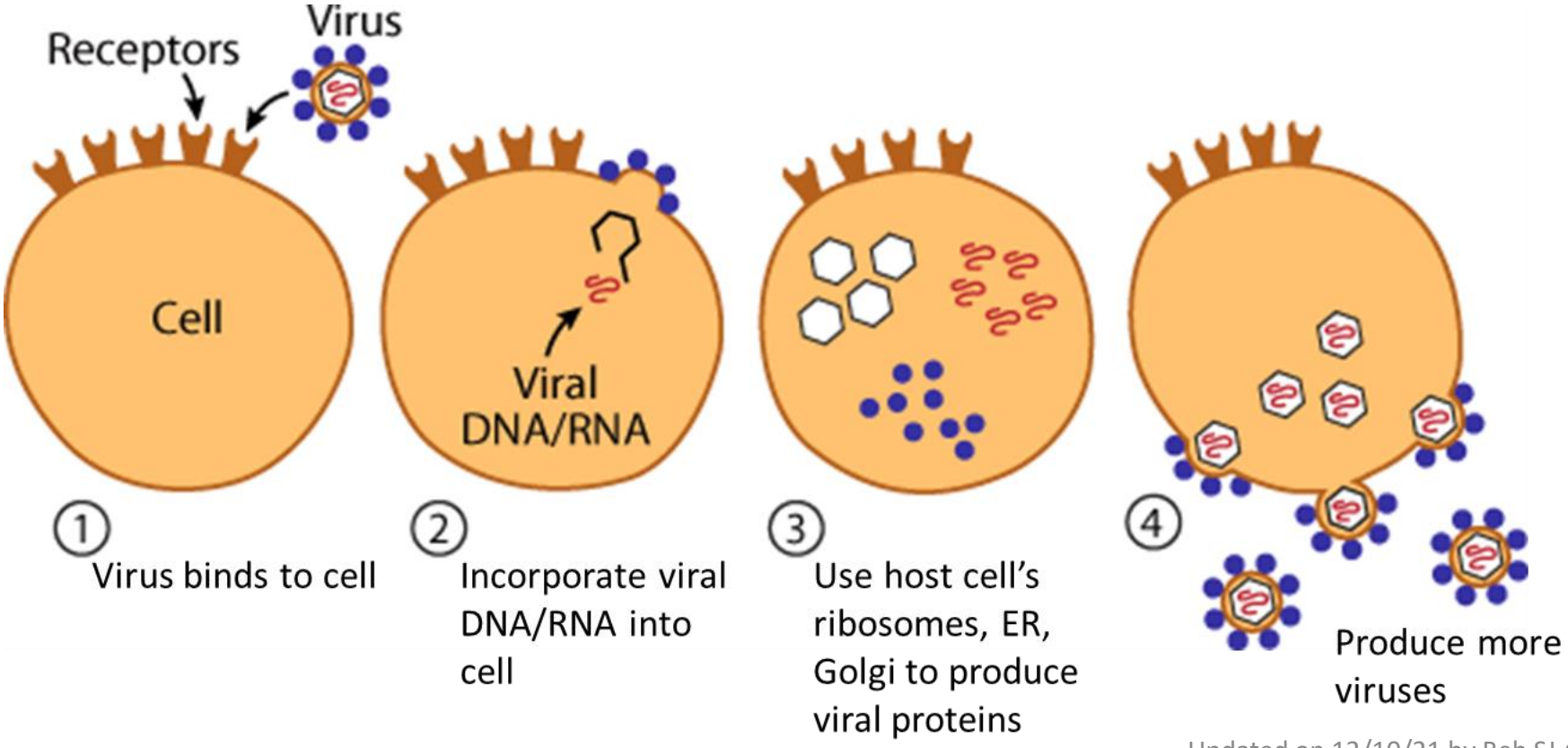
3. Many viruses also have a **lipid envelope**
4. Some proteins may be present

- e.g. haemagglutinin, neuraminidase



Viruses

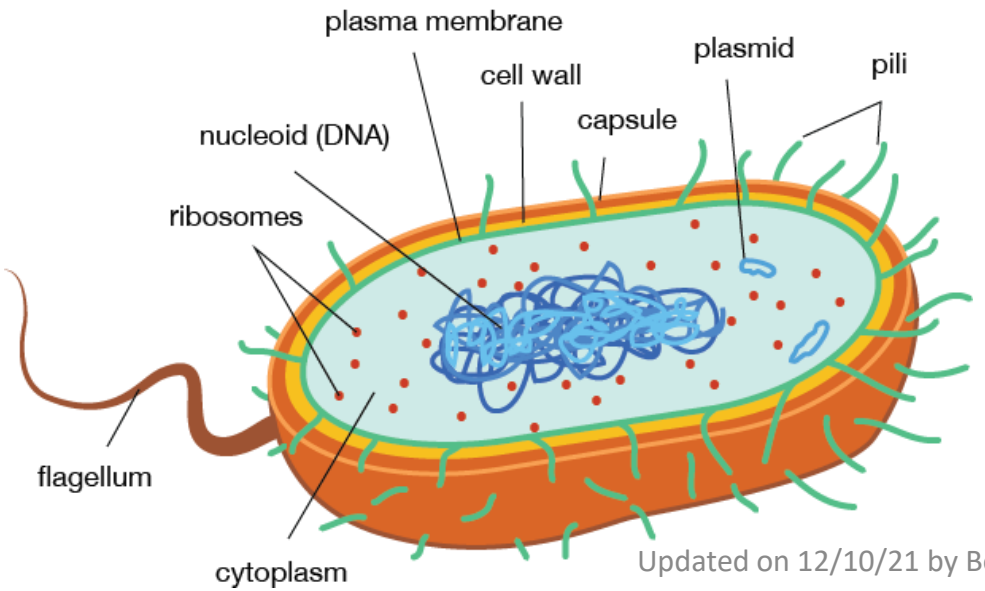
- All **parasitic**
- Can only reproduce by **infecting** living cells
- **Uses protein synthesising machinery** of host cell to replicate



Bacteria

What all bacteria do not have:

- **No membrane-bound organelles**
- **No nucleus**
  DNA lies free in cytoplasm in the **nucleoid region**



What all bacteria have:

- Plasma membrane
- Cytoplasm
- **Peptidoglycan cell wall**

→ made of chains crossed linked by amino acids

- **70S ribosomes**
- **Circular DNA**
- DNA is **naked**

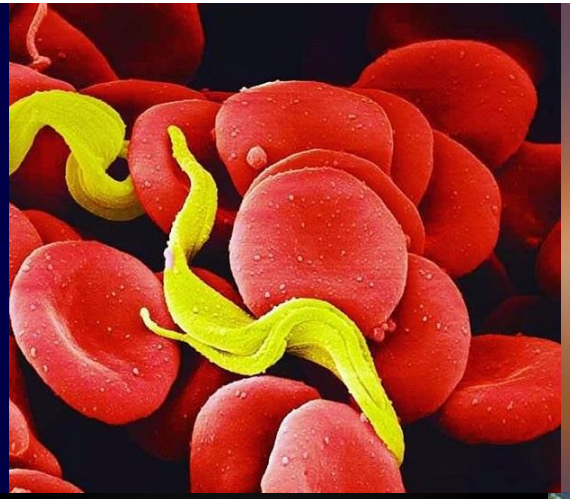
→ not associated with proteins

Guess the type of causative organisms!

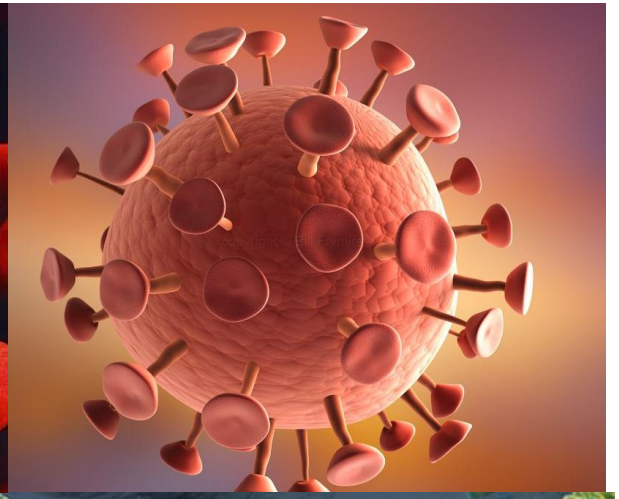
Is it a Bacteria/Virus/Protoctist?

bacteria

protoctist

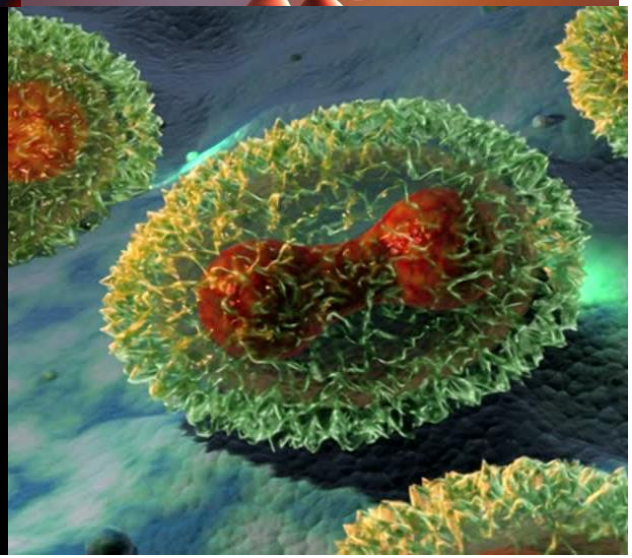


virus



bacteria

virus



virus

Types of Pathogens

Disease	Type of causative agent	Name of causative agent (pathogen)
Cholera	Bacteria	*Vibrio cholerae*
Malaria	Protoctist	*Plasmodium falciparum / P. malariae / P. vivax / P . ovale*
HIV/AIDS	(Retro)virus	Human Immunodeficiency Virus
Tuberculosis	Bacteria	*Mycobacterium tuberculosis / M. bovis*
Smallpox	Virus	*Variola* virus

Terminology to describe Distribution of Disease

- **Endemic:** a disease that exists permanently in a particular region or population.

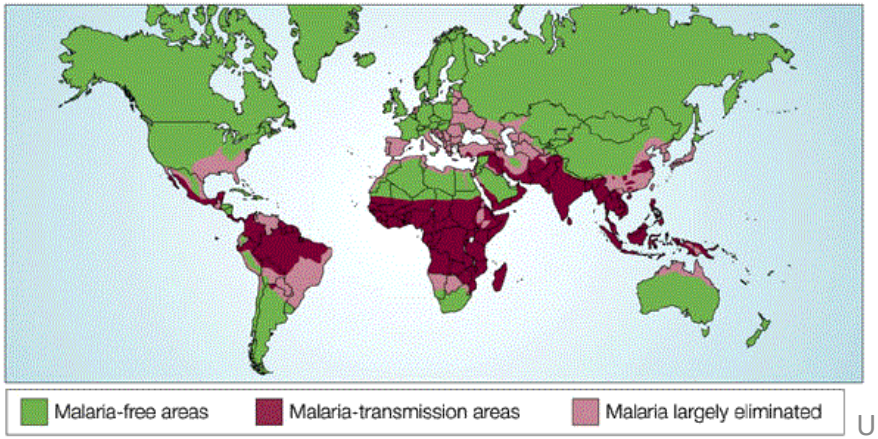
  Malaria is a constant worry in parts of Africa.
  Malaria is endemic in Africa.

- **Epidemic**: An outbreak of disease that attacks many peoples at about the same time and may spread through one or several communities.

  Remember the SARS epidemic in Malaysia?

- **Pandemic**: When an epidemic spreads throughout the world.

  HIV/AIDS is a worldwide pandemic.

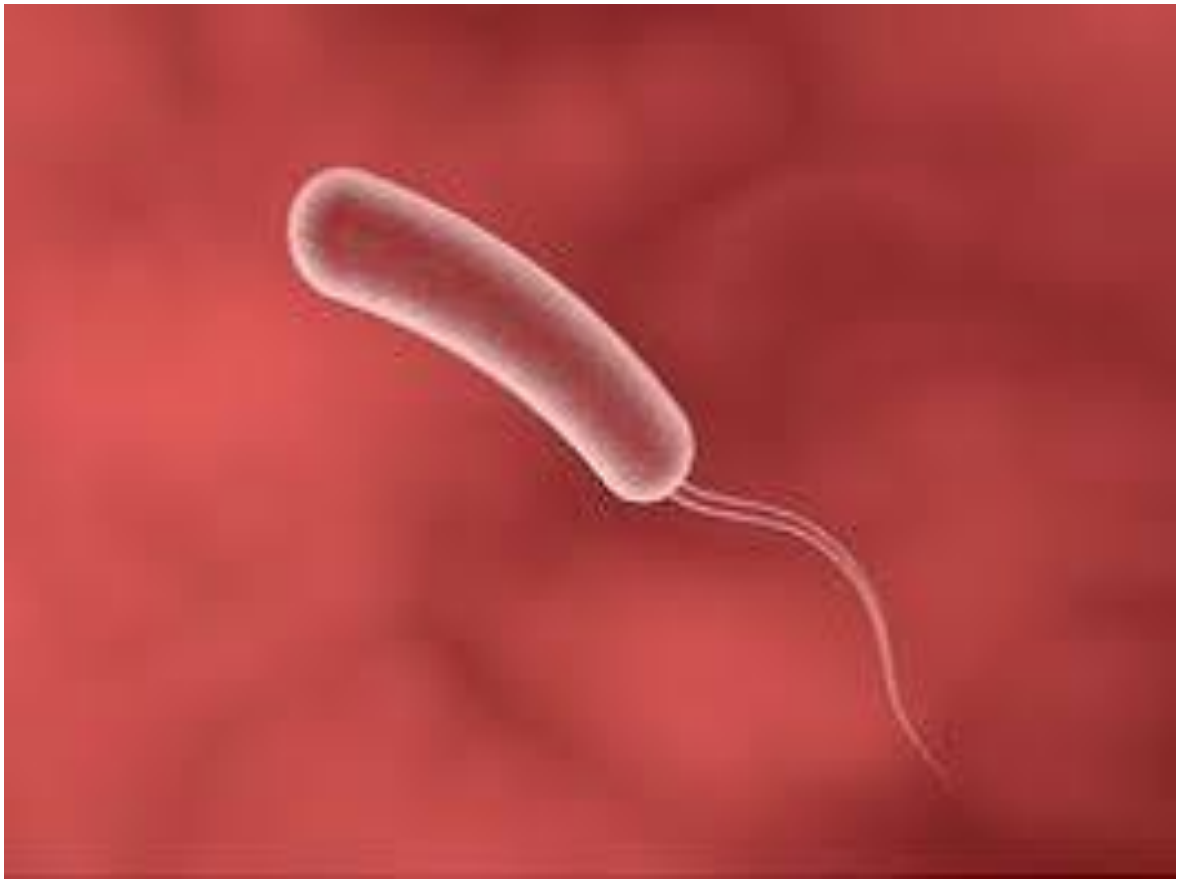


Cholera

Cholera

Causative organism: ***Vibrio cholerae*** – a bacterium

- comma-shaped, has flagella, motile



Cholera

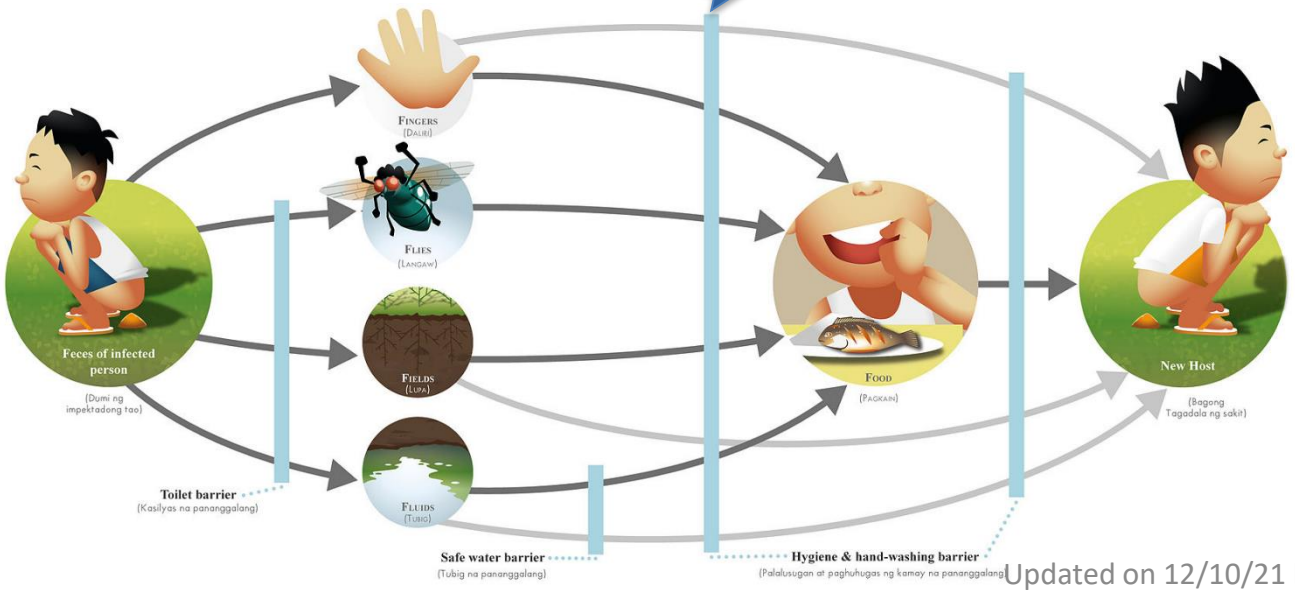
Transmission:

- Large numbers of *Vibrio cholerae* found in faeces of infected people
- **Infected person**'s faeces / sewage contaminates food / water.
- Houseflies land on faeces and contaminate food / water.
- **Uninfected person** eats contaminated food / water.

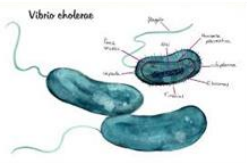
Faecal-oral route

Food-borne

Water-borne



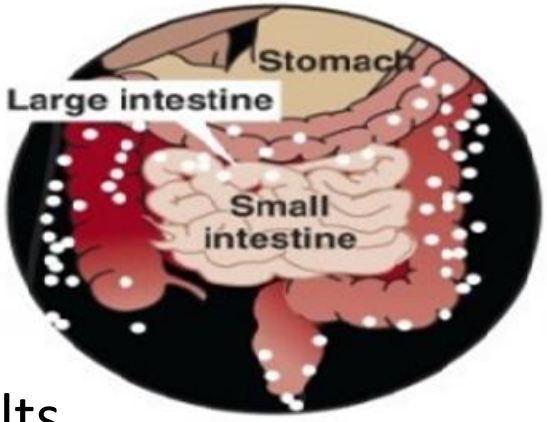
Cholera



Symptoms and Effects:

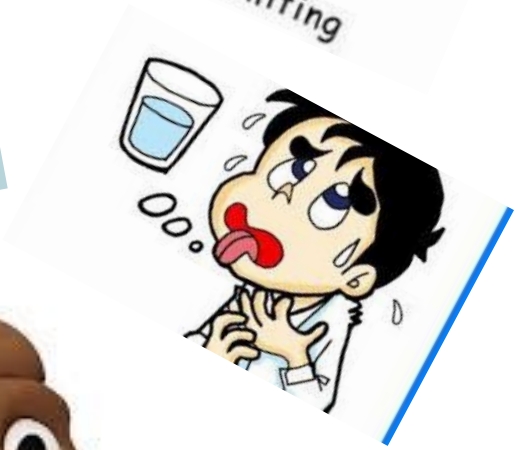
1. If bacteria is not killed by stomach acid, bacteria reaches the small intestine
2. Bacteria secretes **choleragen** toxin
3. Toxin **binds to complementary receptor** on intestinal epithelial cell and enters via **endocytosis**
4. **Disrupts function of intestine epithelium lining**
5. **Loss of chloride ions and sodium ions** from epithelial cells.
6. Water potential decreases, **water moves out** from blood down water potential gradient by osmosis through partially permeable membrane.
7. Causes **severe diarrhoea + dehydration**

Cholera



More Symptoms:

- **Diarrhoea**
- **Severe dehydration**
- Loss of water and salts
- Weakness and Fatigue
- Low Blood Pressure
- Weight Loss
- Vomitting



Diagnosis:

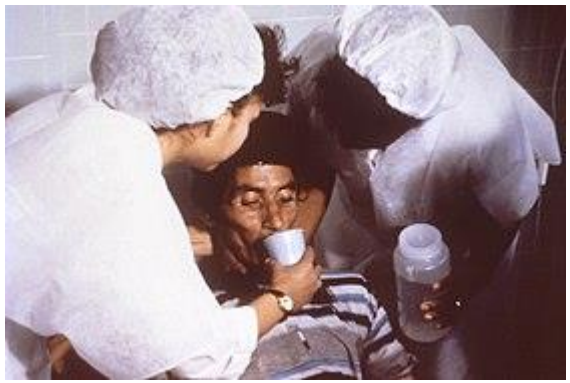
- Microscopical analysis of faeces

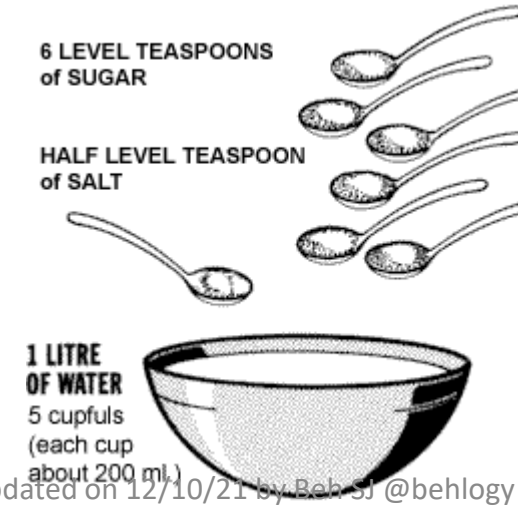
Cholera

Treatment:

- **Oral rehydration therapy**
- Use **oral rehydration solution (ORS)** that has glucose/salts

- Ensure that fluid intake = fluid losses in urine & faeces
- Maintain osmotic balance of blood and tissue fluids
- Almost all treated patients survive

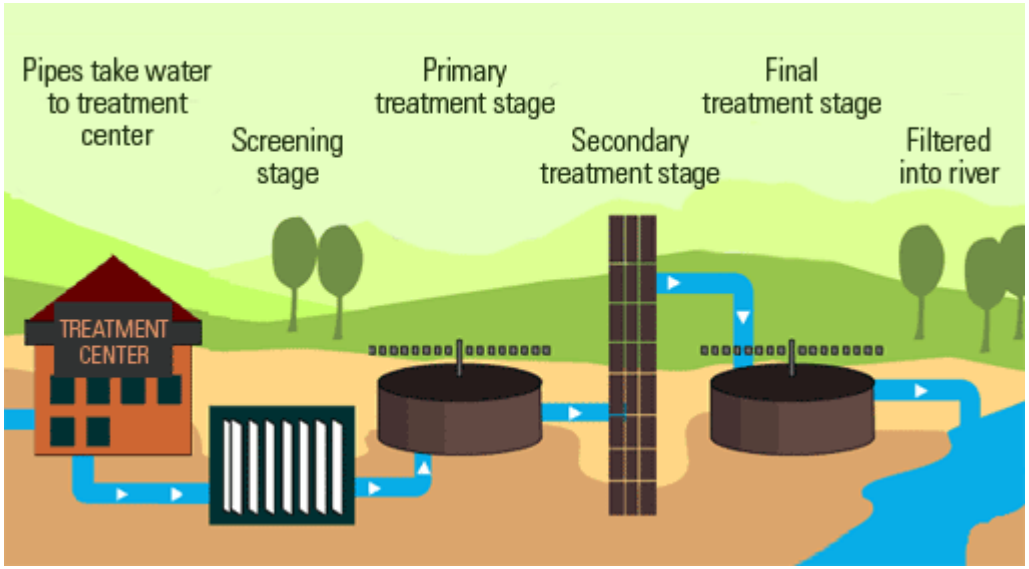




Cholera

Prevention:

- **Proper sewage treatment** to break transmission cycle
- **Chlorinate water** to kill bacteria before drinking
- Drink bottled water
- Vaccination only offers short-term protection (no longer recommended)



Cholera

- About 3 – 5 million cholera cases reported annually
- Responsible for about 110,000 deaths a year

Global Distribution:

- Endemic in **developing countries**
- E.g. West and East Africa, Afghanistan, Latin America, parts of Asia

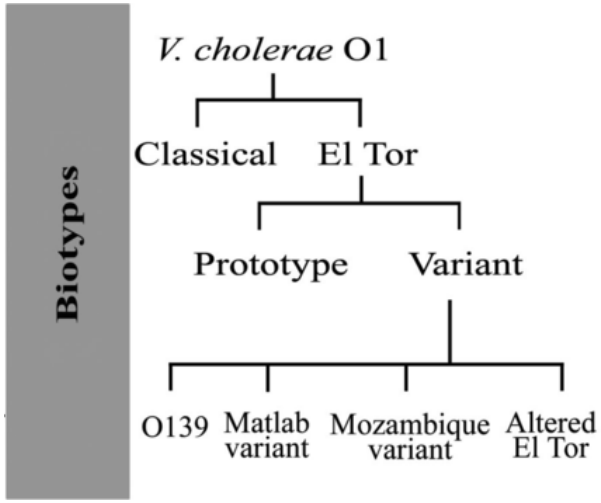
- Outbreak also follows **natural disasters (or war)**
- E.g. chlolera epidemic during the 2010 earthquake in Haiti, 2014-2016 outbreak in Yemen

- Due to **absence of proper sanitation** – no treatment of faecal waste → water supply contaminated
- **Poor hygiene and poor living conditions**
- **Lack of education about transmission**

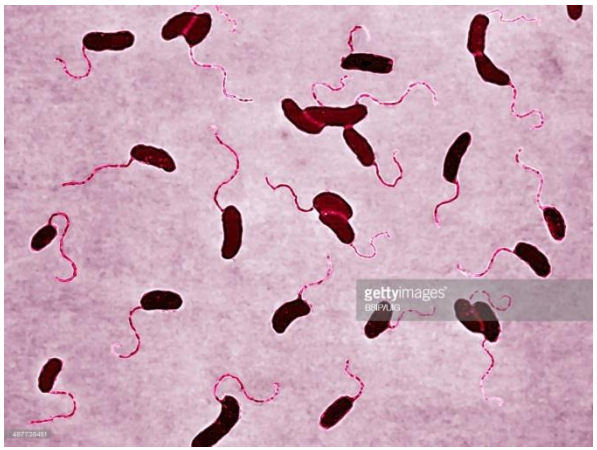
Cholera

Other Problems:

- Many different strains of *Vibrio cholerae*
- E.g. classical/O1, El Tor, O139
- Each strain that caused a pandemic is more virulent than the last



- Adults can be reinfected and have cholera again
- This is also why it is **hard to vaccinate against cholera**

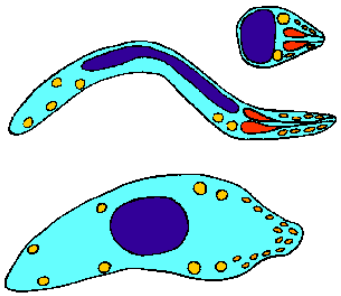


Malaria

Malaria

Causative organism : *Plasmodium* – a protoctist (eukaryote), parasite

- In humans, malaria is caused by ***Plasmodium falciparum*** (75%) **, *P. malariae, P. ovale, P. vivax*** (20%).
- Appearance changes depends on life cycle stages
- Plasmodium is most motile during initial infective stages



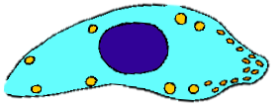
Vector/Transmission:

- Vector = Organism that carries a disease from a person to another/from an animal to a human
- Insect vector = **Female *Anopheles* mosquitoes**
- Only female take blood meals to supply eggs with nutrients
- Also through blood transfusions, use of unsterile needles, and can pass across placenta from mother

Malaria

Mos takes a blood meal from **infected person** and then takes a blood meal from **uninfected person**.

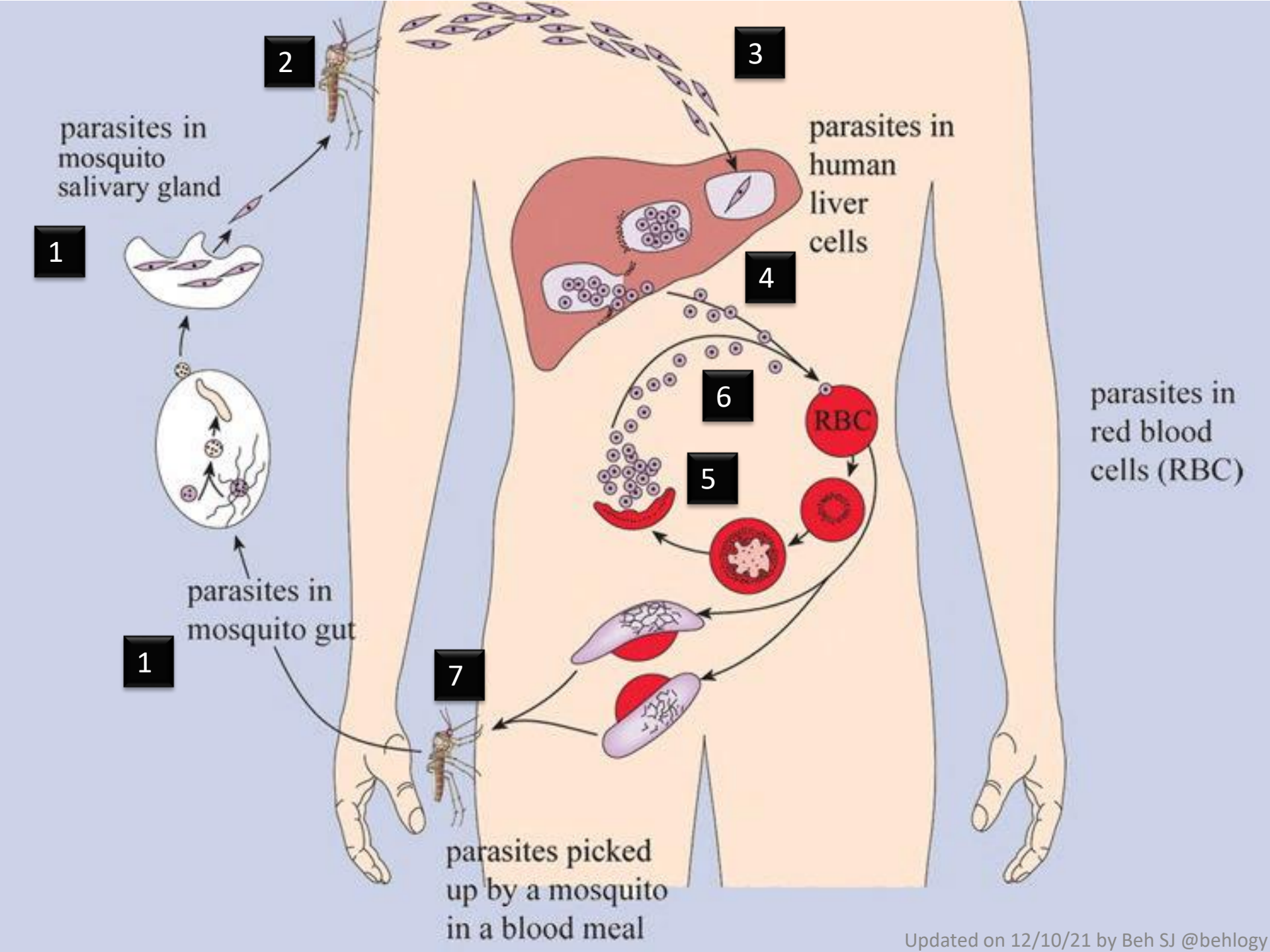
Life cycle of *Plasmodium:*

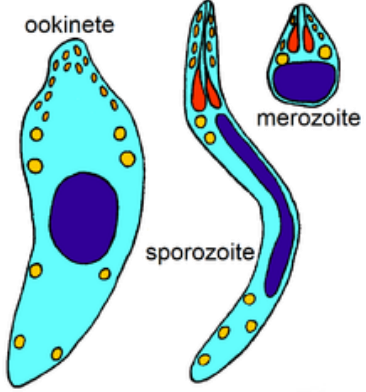


1. Plasmodium's gametes fuse, multiplies in and form infective stages in mosquitoes

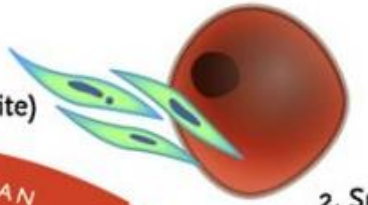
2. When mos takes a blood meal, **parasite enters host with mos's anticoagulant and saliva.**
3. Infective stages of parasite enter **bloodstream** and then **liver cells**
4. Parasite **matures in liver cells**, then leaves liver to enter **RBCs**

5. Parasites **multiply** in RBCs, causing **RBCs to lyse**
6. Parasites are released and **infect other RBCs**
7. Parasites picked up by another mos in a blood meal


2
3
parasites in
mosquito
salivary gland
parasites in
human
liver
cells
1
4
6
RBC
5
parasites in
red blood
cells (RBC)
parasites in
mosquito gut
1
7
parasites picked
up by a mosquito
in a blood meal

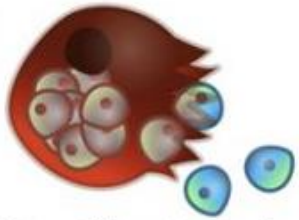


1. Transmission to human (injects sporozoites via bite)



2. Sporozoites enter liver and infect hepatocytes (liver cells)

mitotic replication



3. Liver cells rupture and merozoites released

(RBC)

5. Sexual cycle (merozoites produce gametocytes instead)

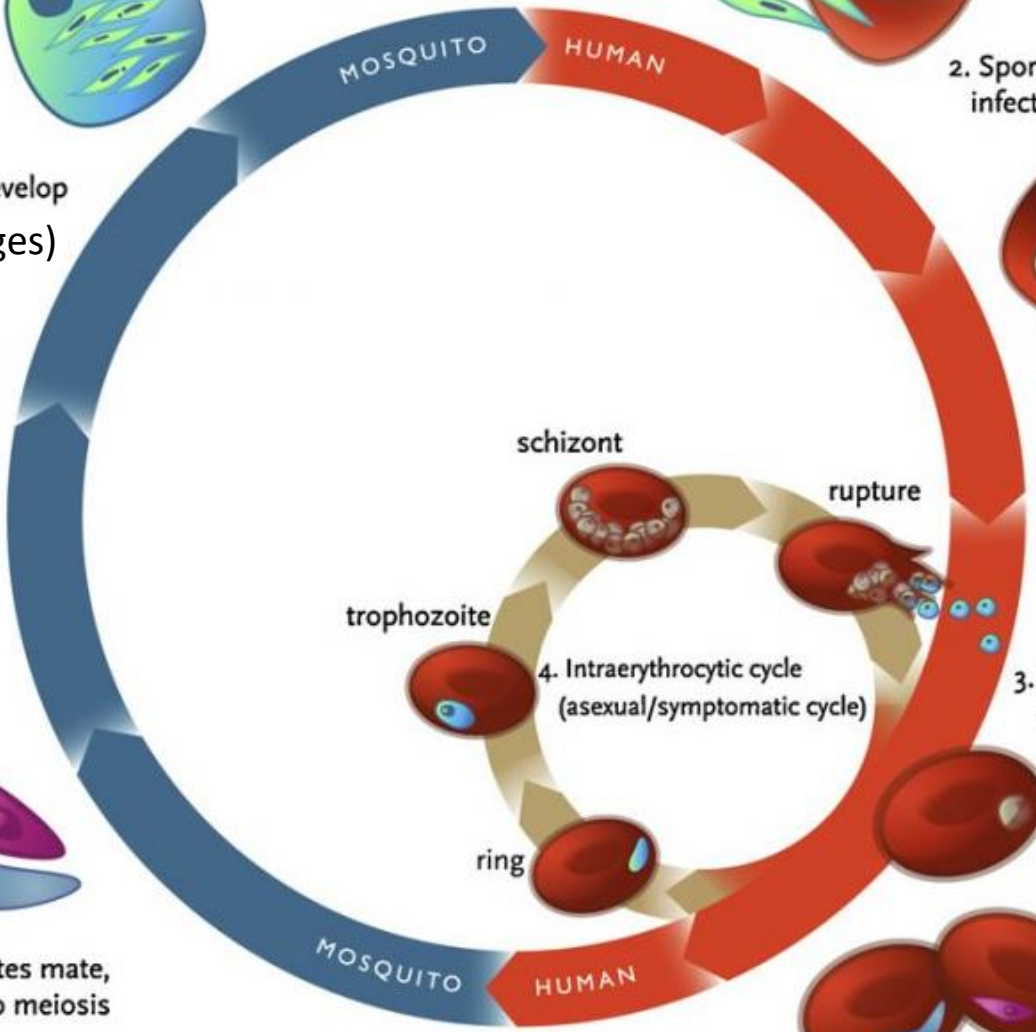
6. Transmission to mosquito (ingests gametocytes via bite)

7. Gametocytes mate, undergo meiosis

8. Migrates through midgut wall, forms oocyst

9. Sporozoites develop

(sporozoites = infective stages)

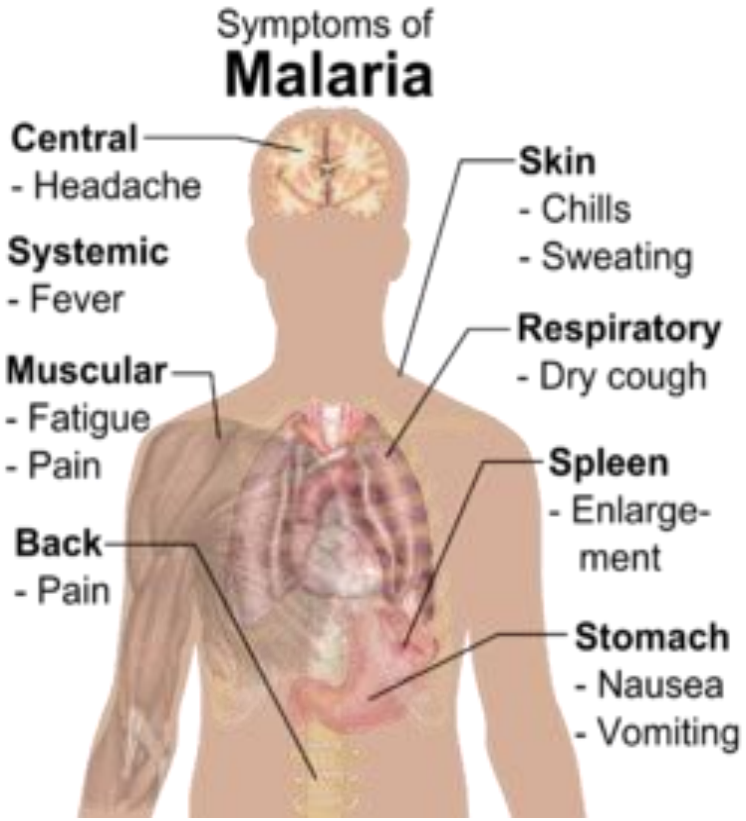


You do not need to know the names of the diff stages/forms – just know that there are many.

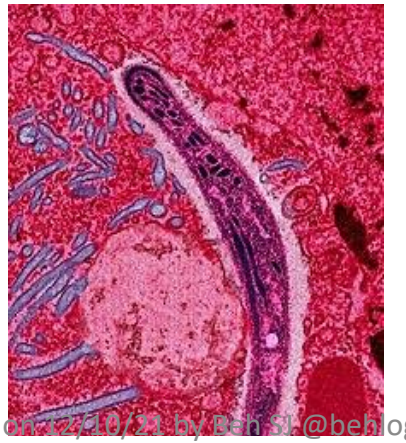
Malaria

Symptoms:

- Fever
- **Anaemia**
- Nausea
- Headaches
- Muscle pain
- Shivering
- Sweating
- Enlarged spleen



False-colored electron micrograph of a Plasmodium



Diagnosis:

- Microscopical analysis of blood
- Dip stick test for malaria antigens in blood

Updated on 12/10/23 by Ben SL@beblogy

Malaria

Treatment:

- **Anti-malarial drugs**
  - E.g. quinine, **chloroquine**, artemisin
  - Chloroquine inhibits protein synthesis and prevents parasite from spreading within the body
  - Proguanil inhibits sexual reproduction of *Plasmodium* in the mos

- **Combination therapy** = where multiple drugs are used at the same time → used to prevent drug-resistance

Malaria

Prevention:

- No vaccine for malaria (more in Chap 11)

1. Use prophylactic / preventive drugs (e.g. chloroquine)

2. Reduce no. of mosquitoes

- E.g. spray insecticides, spread oil over water surface to prevent mos breeding, breed fish than feeds on larva, spray *Bacillus thuringiensis* bacteria to kill mos larvae etc.

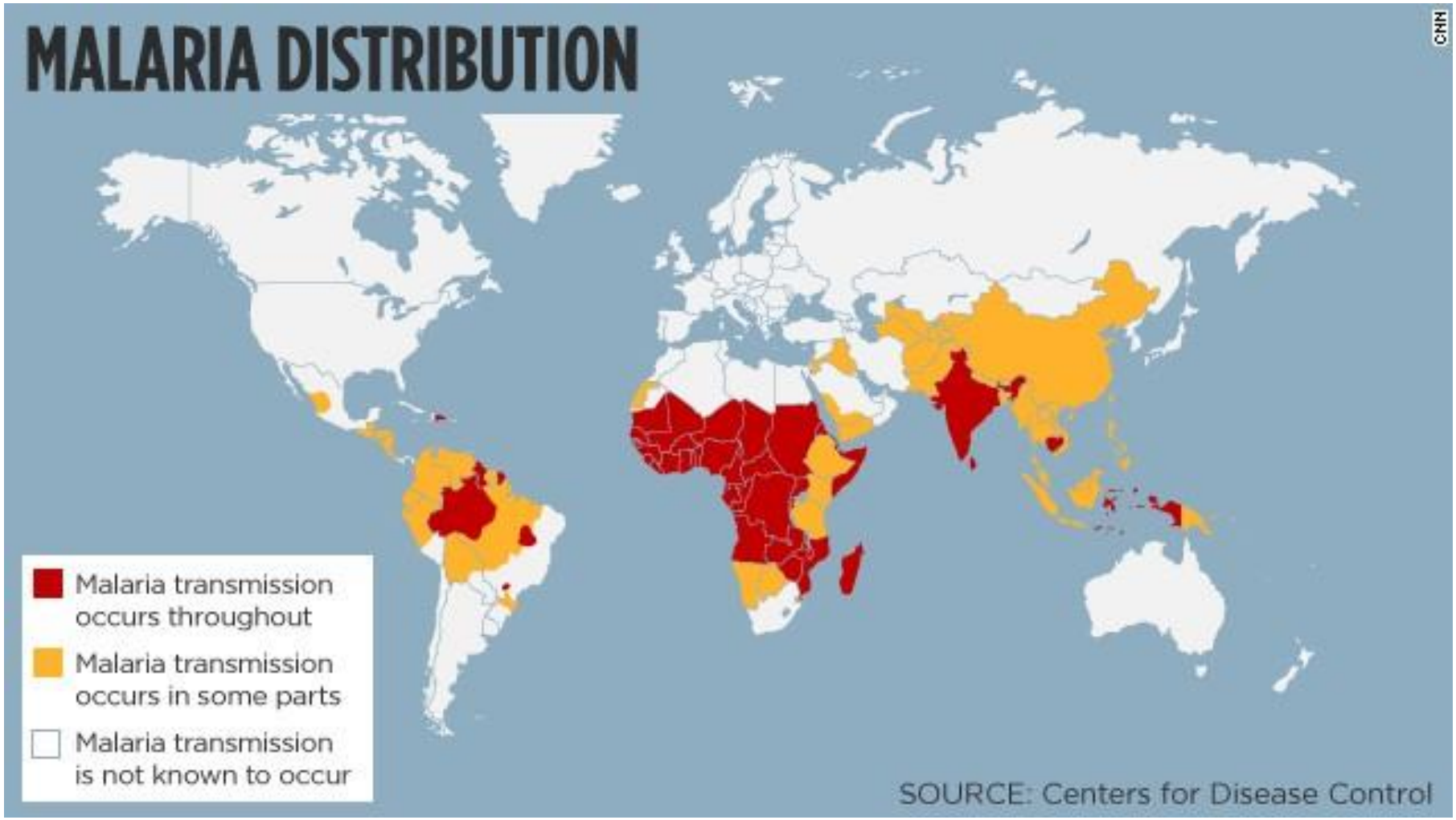
3. Prevention of bites (best method)

- E.g. use mos nets, soak mos nets in insecticide, mos repellent, don't expose skin when mos are active at dusk etc.

Malaria

Global Distribution:

What can you tell about the distribution of malaria from the map below?


MALARIA DISTRIBUTION
CNN
Malaria transmission occurs throughout
Malaria transmission occurs in some parts
Malaria transmission is not known to occur
SOURCE: Centers for Disease Control

Malaria

Global Distribution:

Malaria is **endemic** in….

- Tropical areas
- Sub-tropical areas

WHY?

- The vector, the ***Anopheles*** **mosquito**, survives and breeds in **hot and humid areas**
- Needs still/stagnant water to reproduce
- ***Plasmodium*** reproduces within the mosquito at **>20^{o}C**
- Eradicated outside tropics (e.g. USA, Italy)

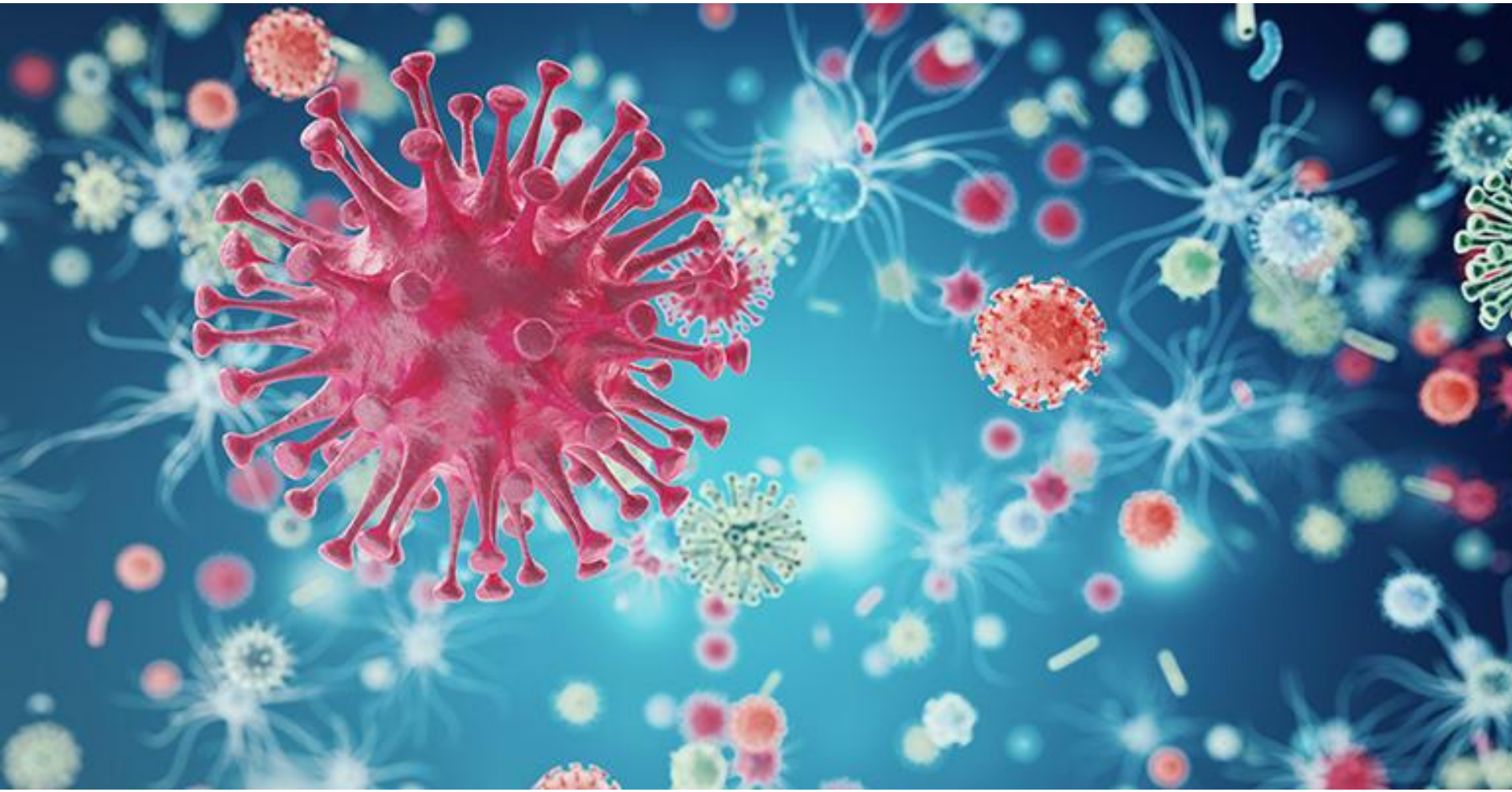
Malaria

Other Problems:

- **Drug-resistant *Plasmodium*** (e.g. chloroquine)

- **Insecticide-resistant mosquitoes** (e.g. DDT)
  - DDT is most common insecticide
  - Insecticides used also killed other organisms
  - Reduction in mos also caused lost in immunity to malaria in local community, making them more vulnerable when the diseased returned.

- **Global warming** has resulted in spread of mos
  - More warm areas for mos to breed and survive



Acquired Immune Deficiency Syndrome (AIDS)

HIV/AIDS

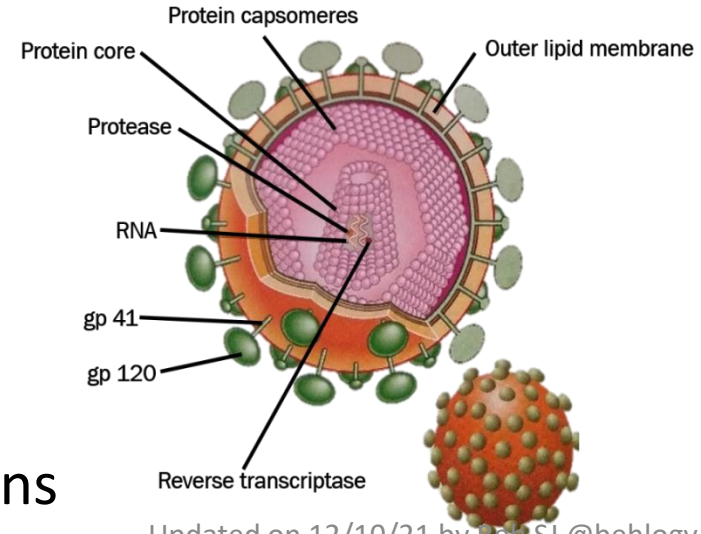
Causative organism: human immunodefiency virus (HIV) – a virus

- It is a **RNA virus / retrovirus**
- Contains single-stranded RNA as genetic material

- Has **protein coat**/capsid made of capsomeres
- Has outer **viral envelope** made of a lipid bilayer and proteins (mostly derived from host)
- Has viral glycoproteins on the outer envelope

- Has 2 enzymes:

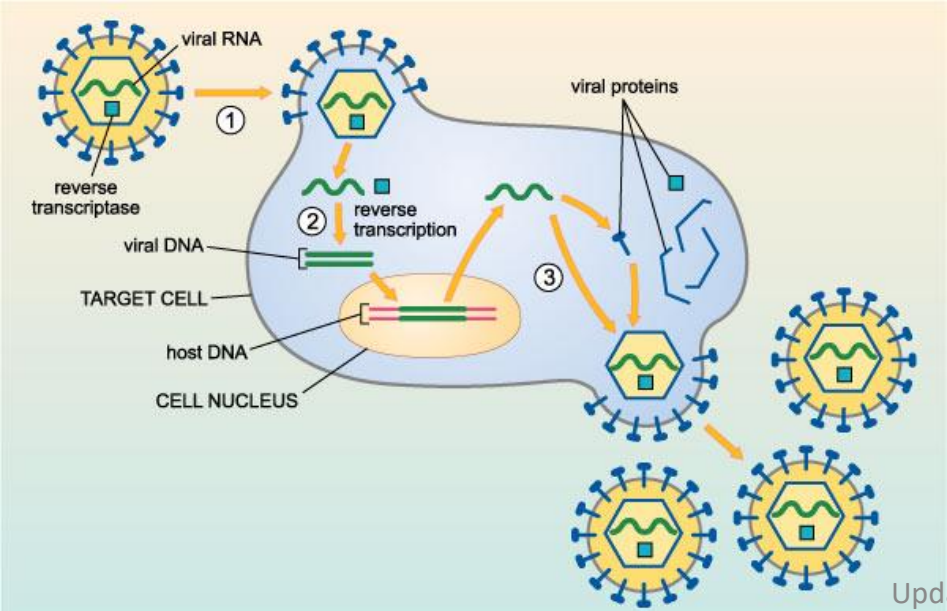
1. **Reverse transcriptase** uses RNA as template to produce DNA in host cell
2. Protease: cleave/process new viral proteins



HIV/AIDS

Life cycle of HIV:

1. The viral RNA and **reverse transcriptase (RT)** enters T helper lymphocytes
2. RT converts RNA into DNA
3. The **viral DNA is incorporated into the host DNA**
4. The cells' machinery is used to express viral proteins (through transcription and translation)
5. Viral proteins are assembled into many new viruses



HIV/AIDS

Transmission:

- **Through direct exchange of body fluids**
- Virus is unable to survive out the human body

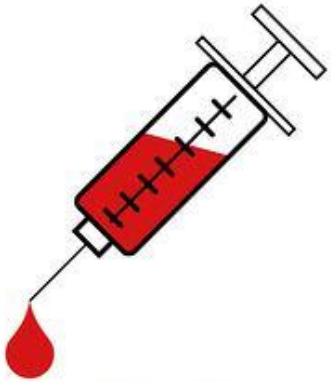
- Semen, vaginal fluids during ***unprotected*** **sexual intercourse**
- **Blood transmission** via infected blood transfusion / contaminated syringes
- **Mother to baby transmission** across placenta / breast milk

- Having multiple sex partners allows virus to spread more widely
- Anal intercourse increases risk of transmission
- Bcs less natural lubrication in the rectum, so rectal lining is easily damaged and virus can pass from semen into blood

Unprotected sexual intercourse with an infected partner

Vertical transmission
(from mother to child)

- in utero
- during delivery
- breastmilk



Injection drug use
(rare: infected blood/blood products)

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HIV/AIDS

Symptoms and Effects:

- **Slow infection** - virus can stay dormant for years
- **Changes surface proteins to hide from immune system**

- HIV infects cells of the immune system, called **helper T cells**
- This destroys helper T cells / cause their no. to decrease
- Body is unable to defend itself against infection

Symptoms of HIV infection:

- Flu-like symptoms and then symptomless (since virus can stay dormant for years)

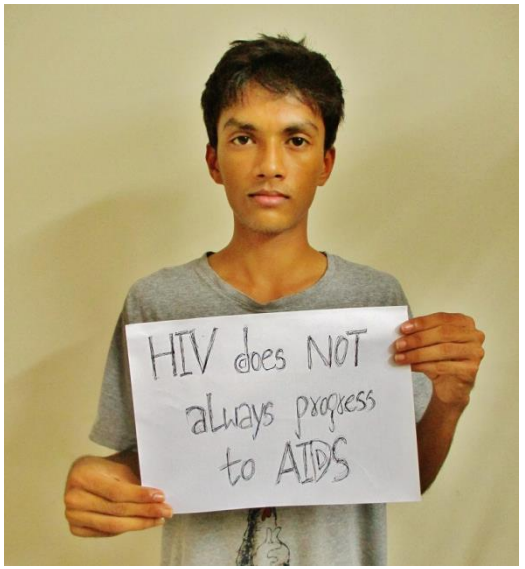
- **Opportunistic infections** can occur as result of a compromised immune system
- Collection of opportunistic diseases associated with immunodeficiency caused by HIV = **AIDS**

AIDS

Symptoms and Effects:

Opportunistic infections:

- oral thrush
- pneumonia
- cancers like Kaposi's sarcoma
- neurogenerative diseases like dementia
- tuberculosis (TB)
- malaria
- malnutrition
- weight loss
- diarrhoea
- fever
- sweating



HIV/AIDS

Treatment:

- No cure for AIDS

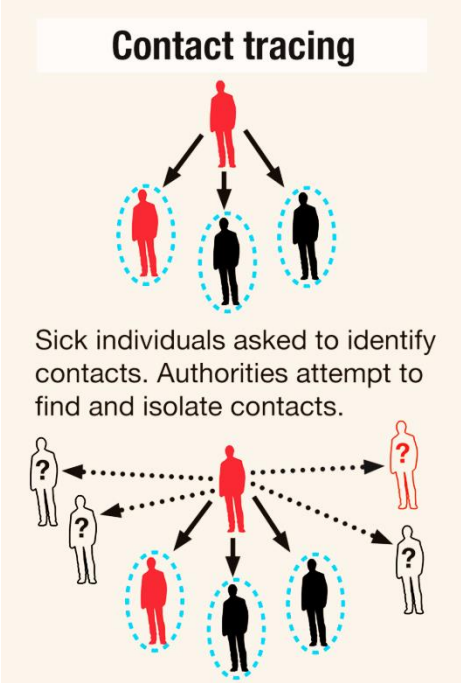
- **Drug therapy can only slow down the onset of AIDS.**
  - **Zidovudine** (similar to the nucleotide base that contains Thymine) binds to viral enzyme reverse transcriptase and inhibits it
  - Drugs can target viral protease and inhibit it as well
  - However, drugs are expensive and have a variety of side effects

- **Combination therapy**
  - Must follow a strict pattern and timing of medication
  - If not followed properly, patients may develop strains of HIV resistant to drugs.

HIV/AIDS

Prevention:

- No vaccine
- Use of **condoms, femidoms** and dental dams



- **HIV testing** promoted in high-risk groups (e.g. male homosexuals, prostitutes, injecting drug users, sex partners)
- **Contact tracing** = where the person with HIV traces people he/she has put at risk of infection and that person to provided a HIV test

- **Discourage needle sharing**
- **Donated blood is screened for HIV and heat-treated to kill viruses**
- Take PrEP, a prophylactic drug (not in syllabus)

HIV/AIDS

- Control mother-to-child transmission using drugs
- **HIV+ women** of high income countries **should avoid breastfeeding** to reduce transmission
  - **BUT** HIV+ women of low/middle income countries advised to breastfeed bcs milk provides protection against other diseases and lack of clean water outweigh the risk of transmitting HIV

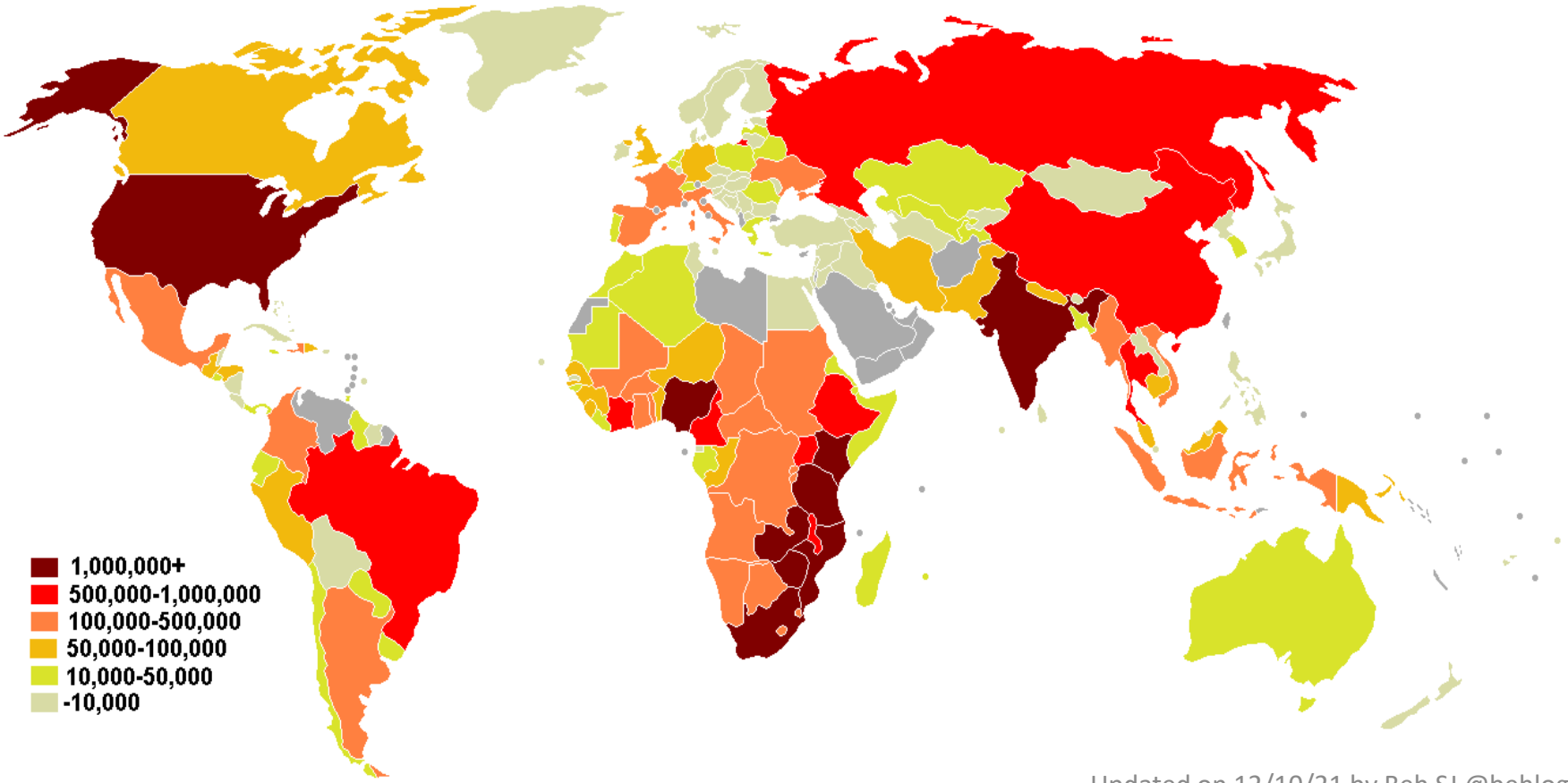
Other problems:

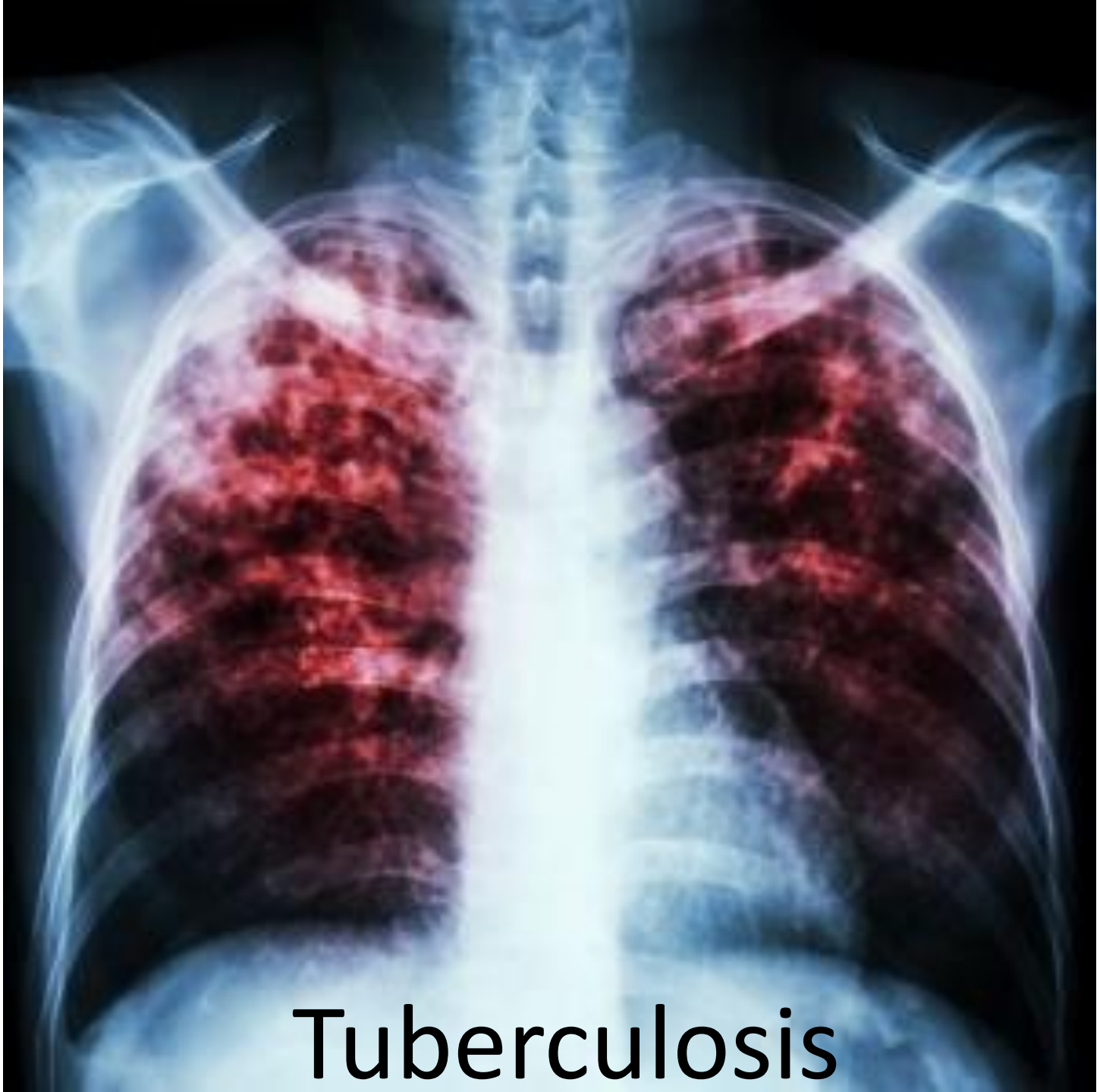
- In Africa, difficult to reach people for widespread testing in rural areas
- Many symptomless carriers
- Drugs are expensive and cause many side-effects

HIV/AIDS

Global Distribution:

- Pandemic in whole world
- But especially high numbers/high prevalence in Africa





Tuberculosis

Tuberculosis

Causative organism: ***Mycobacterium tuberculosis, M. bovis*** – bacteria

- *M. tuberculosis* causes TB in humans
- *M. bovis* causes TB in cows, humans and other mammals

Tuberculosis

Transmission:

Mycobacterium tuberculosis

- **By aerosol infection**
- Pathogen is in airborne droplets
- **Infected person** coughs / sneezes
- **Uninfected person** breathes in droplets

Mycobacterium bovis

- **From infected cows / cattle**
- Eat undercooked contaminated **meat**
- Drink unpasteurised **milk containing bacteria**

Tuberculosis

Symptoms and Effects:

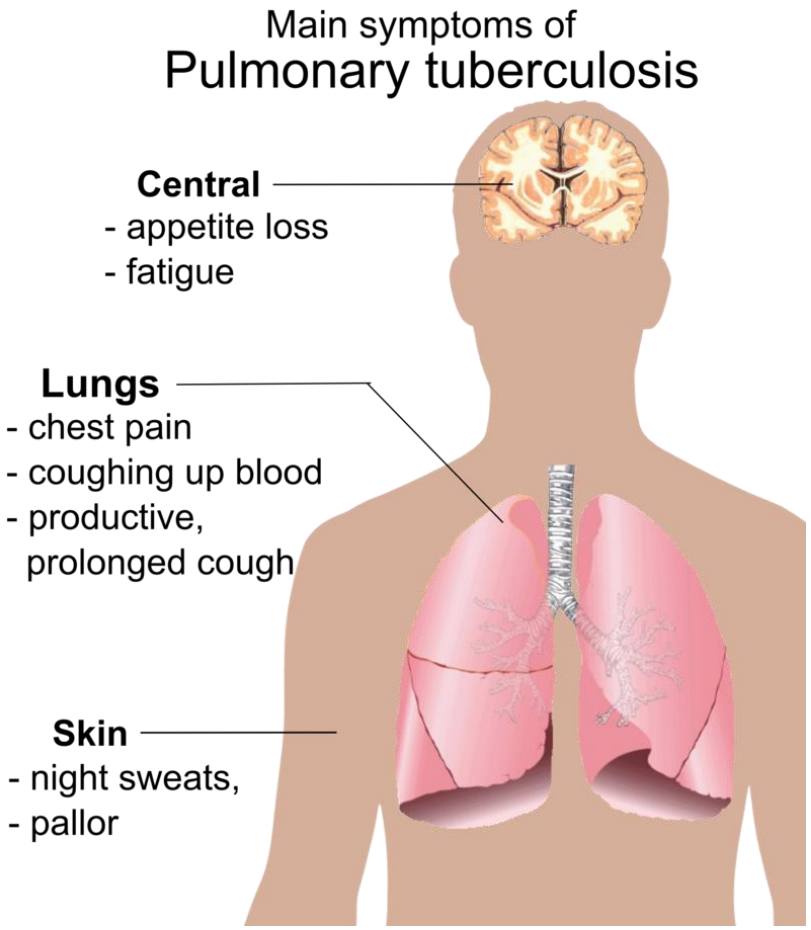
- Site of primary infection = **lungs**
- Secondary infections in lymph nodes, bones and gut

- **Slow infection** - many infections are controlled by immune system and people don't suffer symptoms, cannot pass on the disease
- Bacteria may be activated after many years when immune system weakened by other infections (e.g. HIV)
- The incubation period is few weeks to few years

Tuberculosis

Symptoms and Effects:

- Racking cough
- Coughing blood
- Chest pain
- Shortness of breath
- Fever
- Sweating
- Loss of appetite
- Weight loss



Diagnosis:

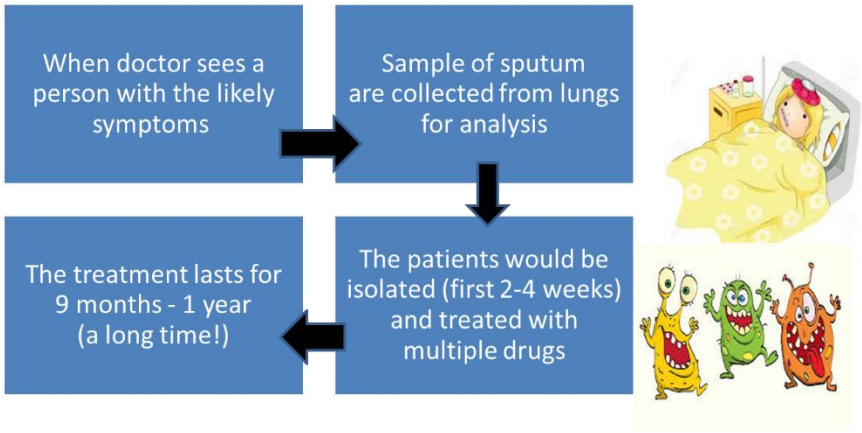
- X-ray
- Microscopical examination of sputum (mucus and pus) for bacteria

Tuberculosis

Treatment:

- Long treatment time bcs bacteria is slow growing and not very responsive to drugs.

- **Combination therapy**
  - **Use multiple antibiotics**
  - E.g. streptomycin, isoniazid, rifampicin
  - Prevent drug-resistance


When doctor sees a person with the likely symptoms
Sample of sputum are collected from lungs for analysis
The patients would be isolated (first 2-4 weeks) and treated with multiple drugs
The treatment lasts for 9 months - 1 year (a long time!)

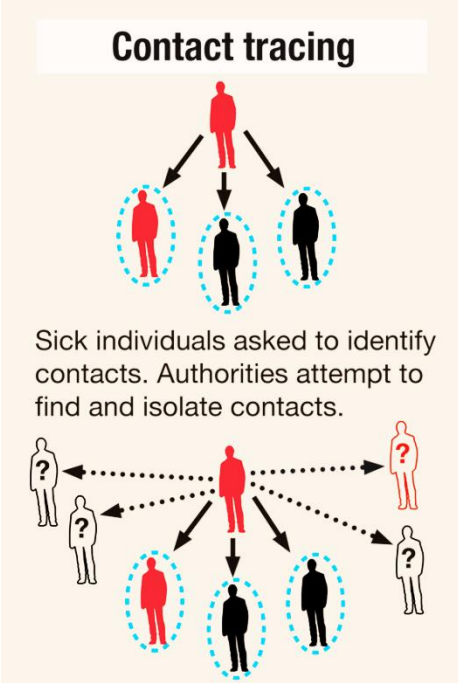
- **DOTS (direct observation treatment, short course)** makes sure patients take medicine regularly and reduce spread of drug resistance

Tuberculosis

Prevention:

- **Bacillus Calmette–Guérin (BCG) vaccine**
- Derived from *M. bovis*

- Isolate patients which are in infectious stages
- **Contact tracing** and **TB screening** for early detection to prevent spread
- Cattle tested for TB
- Pasteurise milk



Tuberculosis

Other Problems:

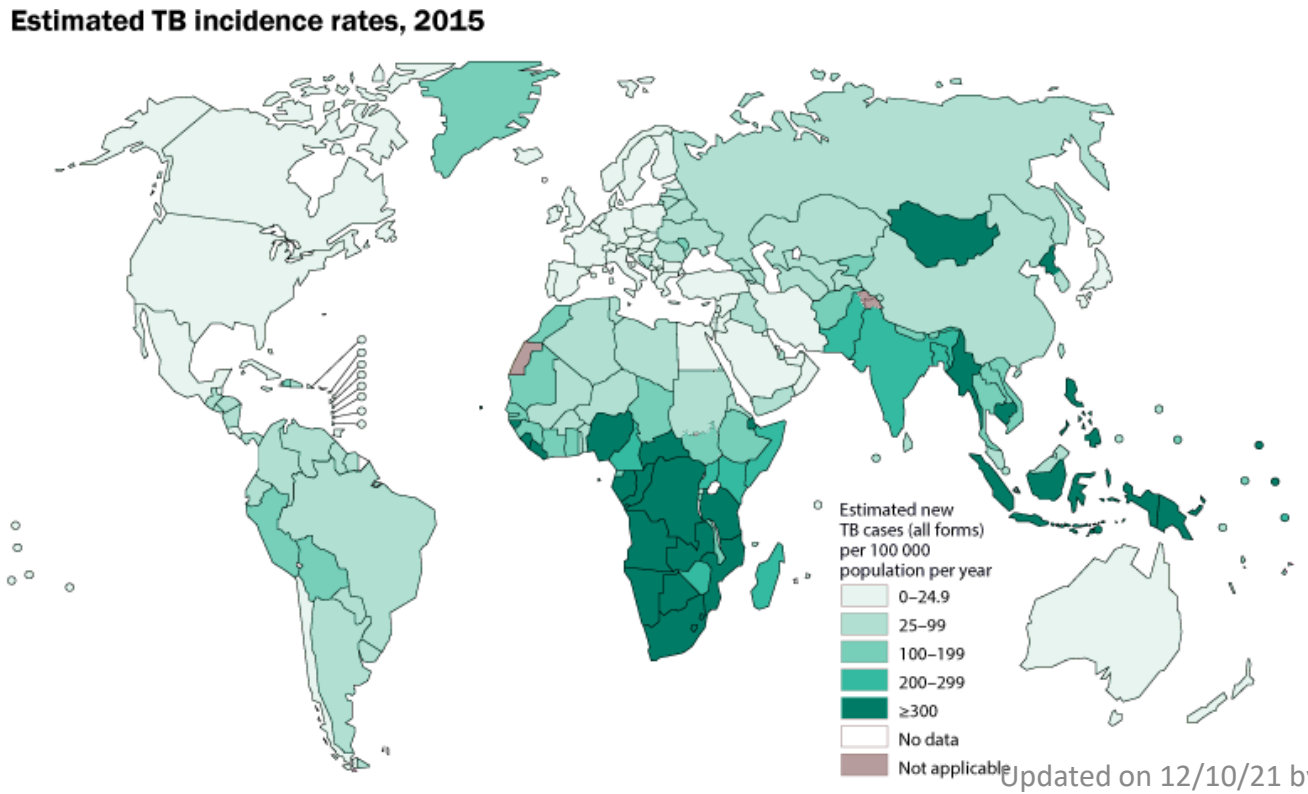
- **Multiple drug-resistant TB (MDR-TB) and extremely drug-resistant TB (XDR-TB)**
- Drugs like isoniazid is no longer effective

- Not completing the course of treatment / partial treatment of TB in patients increase risk of drug resistance

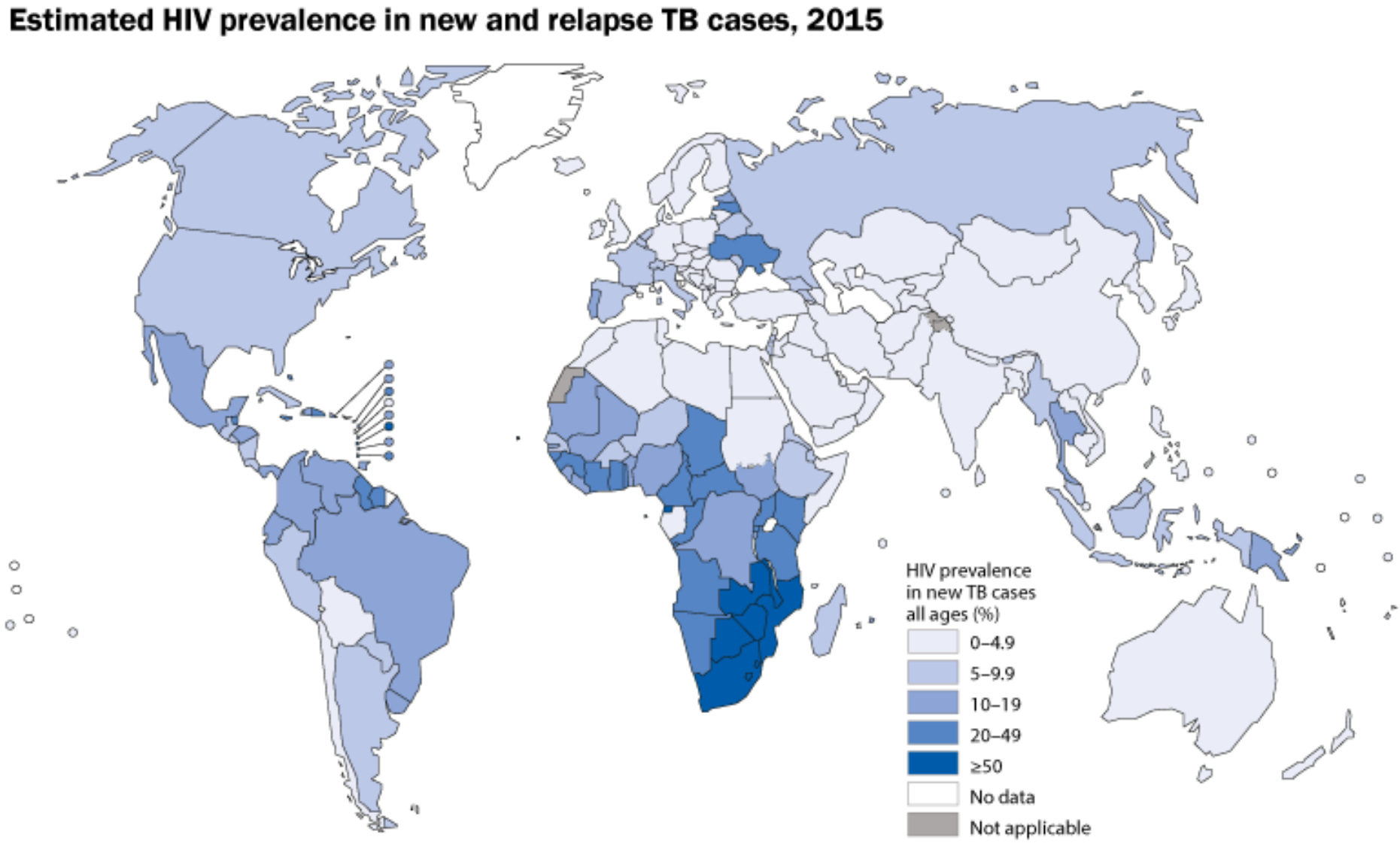
Tuberculosis

Global Distribution:

- Endemic all over the world
- Especially high rates in cities due to high migration rate
- And in **overcrowded** areas where there is poverty
- Also where HIV/AIDS is prevalent



Correlation between global distributions of AIDS and TB

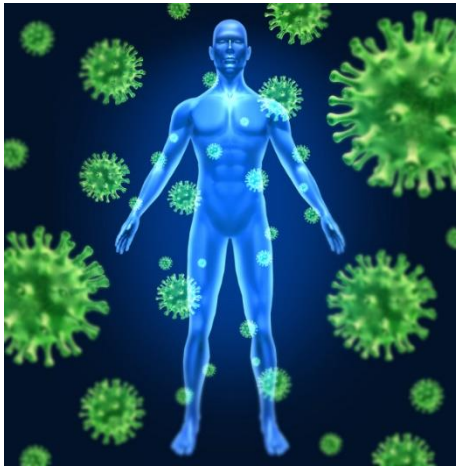


Correlation between global distributions of AIDS and TB

- Countries where many people have AIDS, also have a high death rate from TB
- Many people who have AIDS die of TB

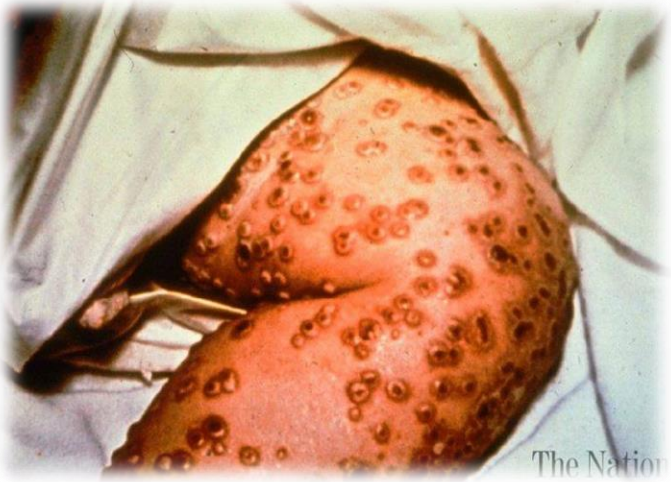
WHY?

- TB is an opportunistic infection
- **People who are HIV+ are more susceptible to TB**
- Dormant TB more likely to become active if person is HIV+



SMALL POX

Smallpox was a devastating disease. On average, 3 out of every 10 people who got it died. Those who survived were usually left with scars, which were sometimes severe.



Smallpox

*only need to know the causative organism

Causative Organism: *Variola* virus

Transmission:

- By aerosol infection
- Air droplets from sneezing and coughing
- Contact with contaminated clothing and bedding

Symptoms:

- Fever, headache, severe fatigue, severe back pain, vomiting
- Rash
- Develop into abscesses with fluid and pus
- The abscesses would break open and scab over
- Scab would fall off and leave scars

Smallpox

Treatment:

- NO cure, although some antiviral drugs may help to prevent it from getting worse

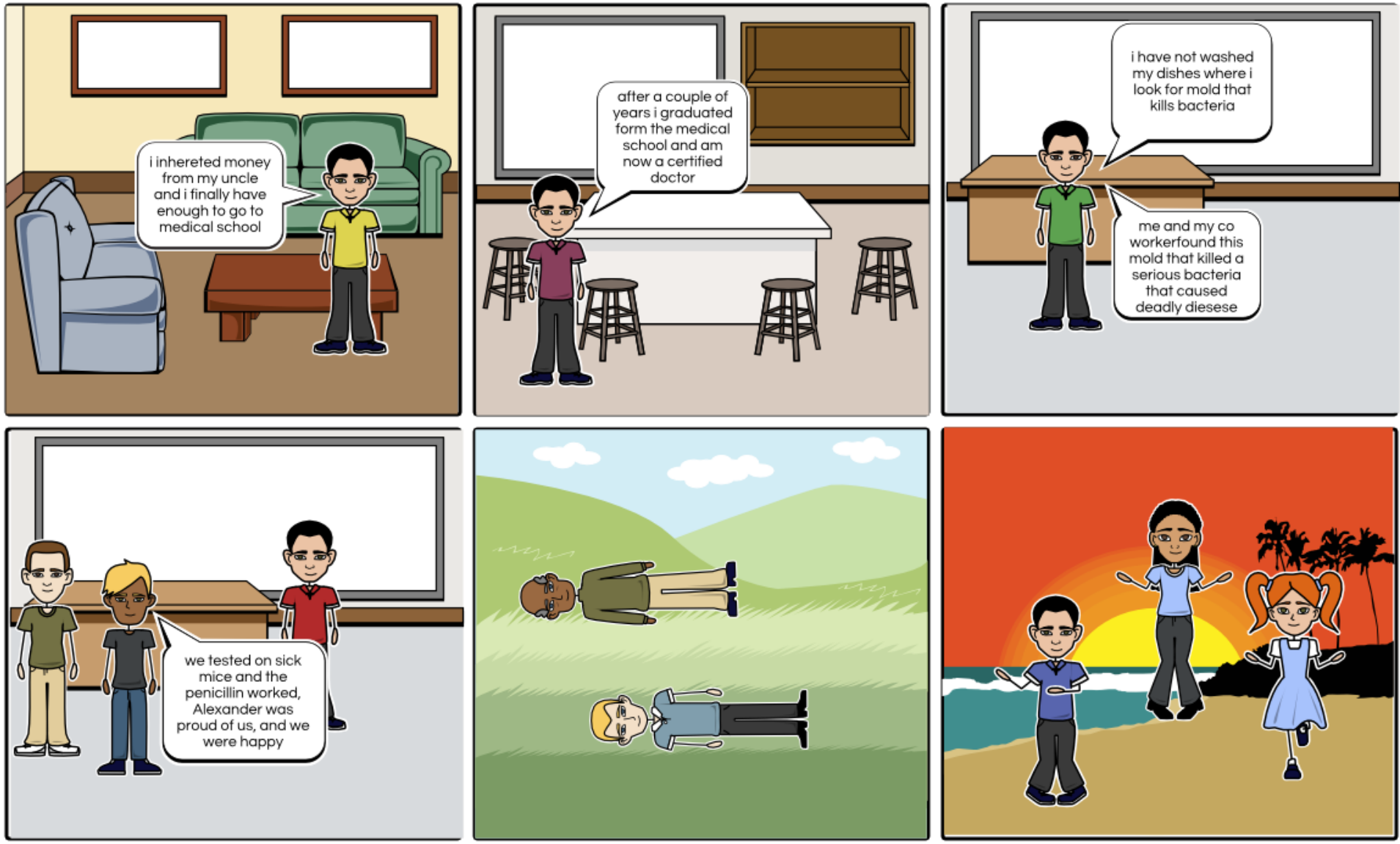
Prevention:

- **Smallpox vaccine**

Fortunately, smallpox has been **ERADICATED**
…..through vaccines!

Antibiotics

How Penicillin was discovered by Alexander Fleming


i inhereted money from my uncle and i finally have enough to go to medical school
after a couple of years i graduated form the medical school and am now a certified doctor
i have not washed my dishes where i look for mold that kills bacteria
me and my co workerfound this mold that killed a serious bacteria that caused deadly diesese
we tested on sick mice and the penicillin worked, Alexander was proud of us, and we were happy

Create your own at Storyboard That

Updated on 12/10/21 by Beh SJ @behlogy

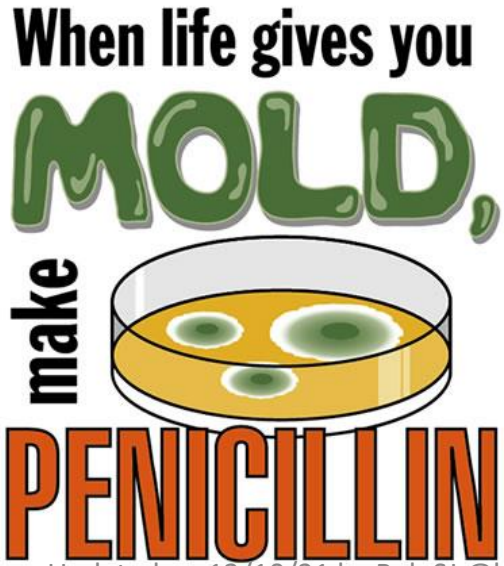
Antibiotics

- Antibiotics are drugs used
- Usually derived from microorganisms
- **To kill / inhibit growth of bacteria**
- Without harming the infected organism

- **Bacteriocidal** antibiotics – kill bacteira
- **Bacteriostatic** antibiotics – inhibit bacterial growth
- **Prevent spread of bacteria within body**

- **Harmless to human cells**

- **Have NO affect on viruses**



Antibiotics

How do antibiotics work?

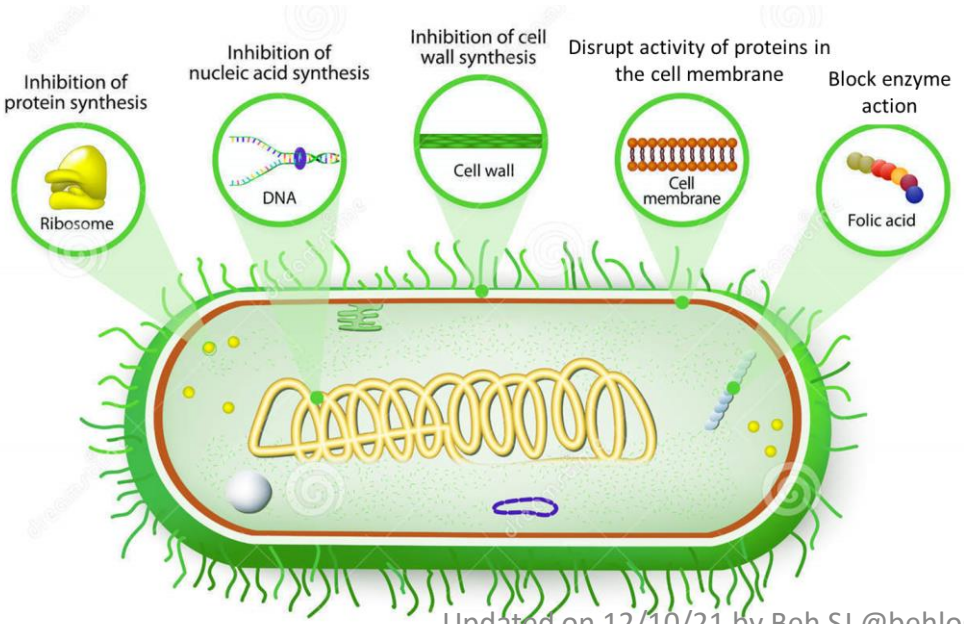
- Inhibit bacterial cell wall synthesis
- Inhibit activity of specific membrane protein / glycoprotein

→ Block binding to cells

- Block specific enzyme action
- Inhibit protein synthesis and nucleic acid synthesis

→ Target enzymes that bacteria have, but humans don't

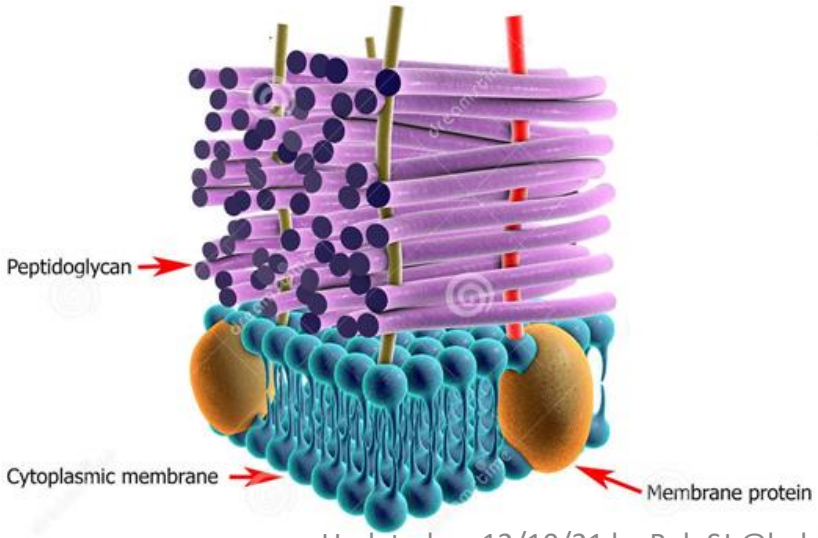
Note: many diff antibiotics each have diff mechanisms



E.g. Penicillin

In the absence of penicillin:

- Bacterial cell wall is made of **peptidoglycans**
- When bacteria cells grow, it secretes **autolysins**
- Autolysins make tiny holes to allow the cell wall to stretch
- New **peptidoglycans** formed
- **Peptidase** enzyme form **cross-links between peptidoglycan chains**
- To form cell wall

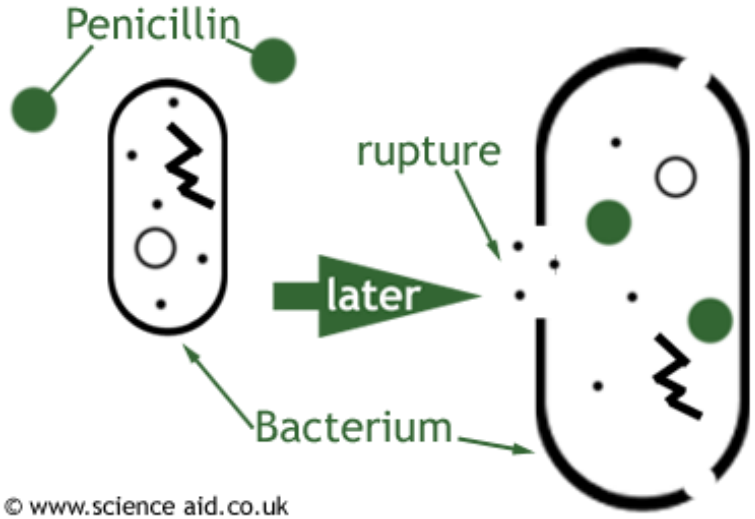


E.g. Penicillin

In the presence of penicillin:

- **Penicillin inhibits peptidase enzyme**
- **Stops formation of cross-links between peptidoglycan polymers in the cell wall**

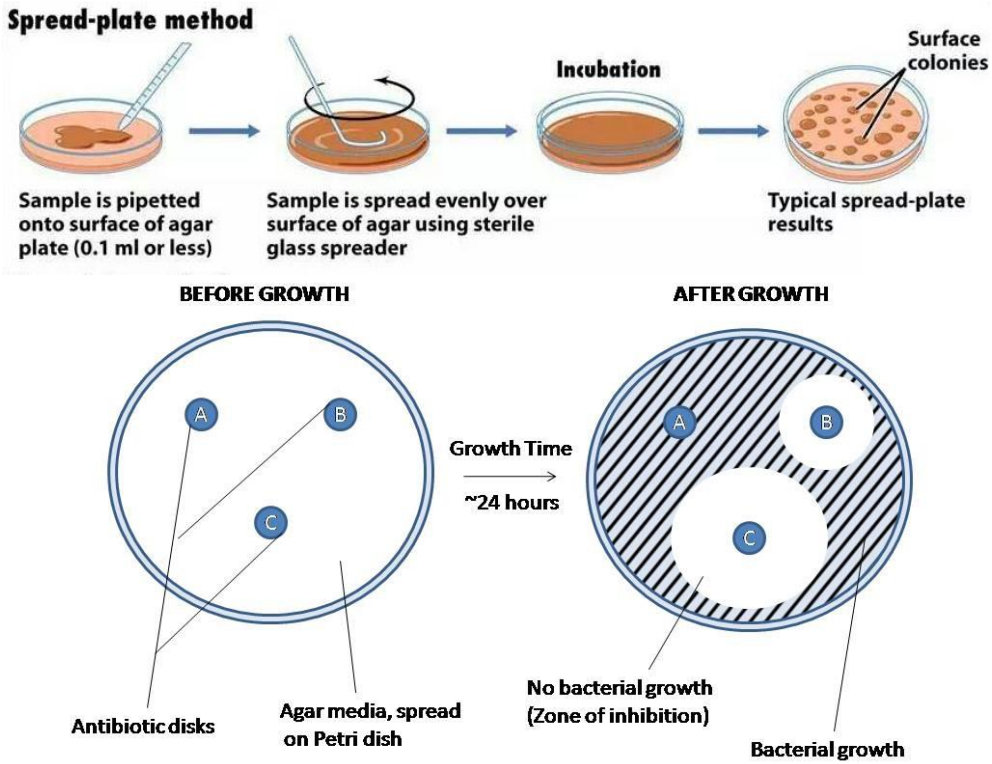
- Autolysins make tiny holes to allow the cell wall to stretch
- New peptidoglycans formed but **cannot link up**
- **Cell wall is weaker**
- Cells walls **unable to withstand turgor pressure**
- When water moves in by osmosis, bacteria **lyses and dies**
- Penicillin is only effective when bacteria is growing

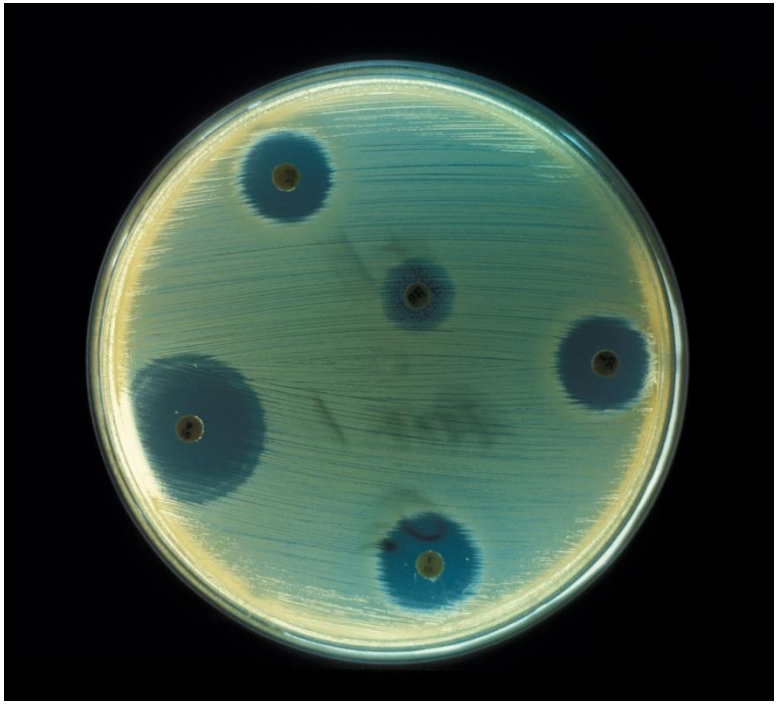


Antibiotics

Diff antibiotics are effective against diff bacteria.

Antibiotic discs can be placed in a Petri dish with growing bacteria. **The diameter of the zone of inhibition shows how effective the antibiotic is.** Which antibiotic is the most effective?





Why antibiotics do not affect viruses

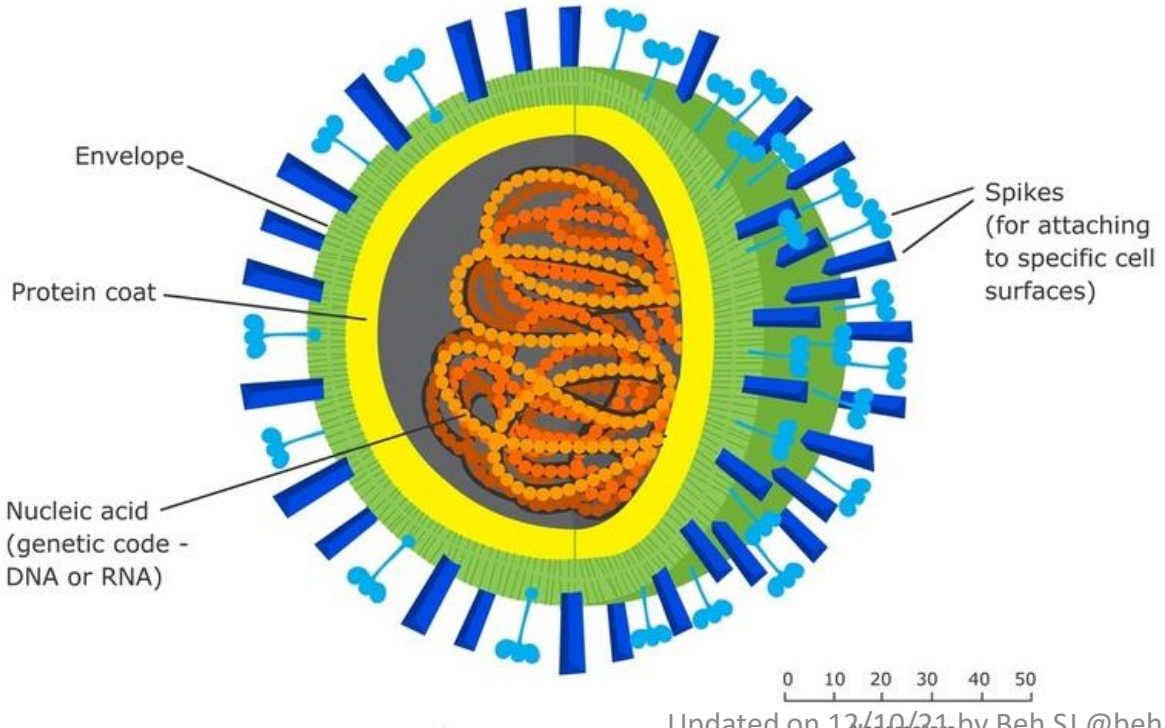
- Viruses **do not** have peptidoglycan cell wall, have protein coat
- Viruses **do not** have their own metabolism, rely on host cells
- Viruses have **no** cell structure / very few organelles
  → **Very few sites for antibiotic to act on**
- Viruses **live inside host cells**, out of reach of antibiotics

- Antivirals exist

→ Usually target viral glycoproteins on viral envelope

→ Prevent binding of virus to host cells

→ Inhibit specific viral enzymes



Antibiotic Resistance

- When antibiotics are no longer effective against bacteria
- Antibiotic resistance can be spread from bacteria to bacteria

E.g.

- Many bacteria have **penicillinase** enzymes can break down penicillin
- Become **resistant to penicillin**

Caused by:

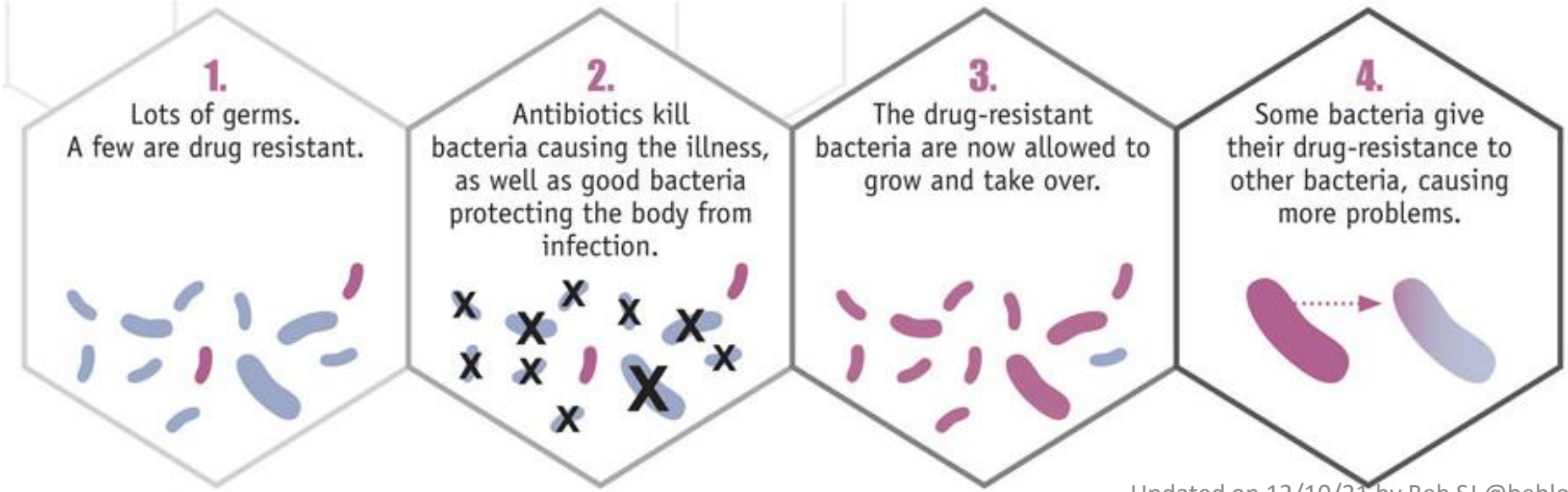
- Spontaneous/random **mutation** in bacteria
- Mutation cause change in protein/production of new protein that cannot be targeted by antibiotics

Antibiotic Resistance

- **Natural selection** enables resistance genes to spread

- **Antibiotic is the selection pressure**
- Antibiotics only kill bacteria that are non-resistant

- Resistant bacteria survive and reproduce
- **Antibiotic resistance gene is spread** to next gen and other bacteria


1.
Lots of germs.
A few are drug resistant.
2.
Antibiotics kill bacteria causing the illness, as well as good bacteria protecting the body from infection.
3.
The drug-resistant bacteria are now allowed to grow and take over.
4.
Some bacteria give their drug-resistance to other bacteria, causing more problems.

Antibiotic Resistance

Antibiotic resistant genes are usually found in plasmids!

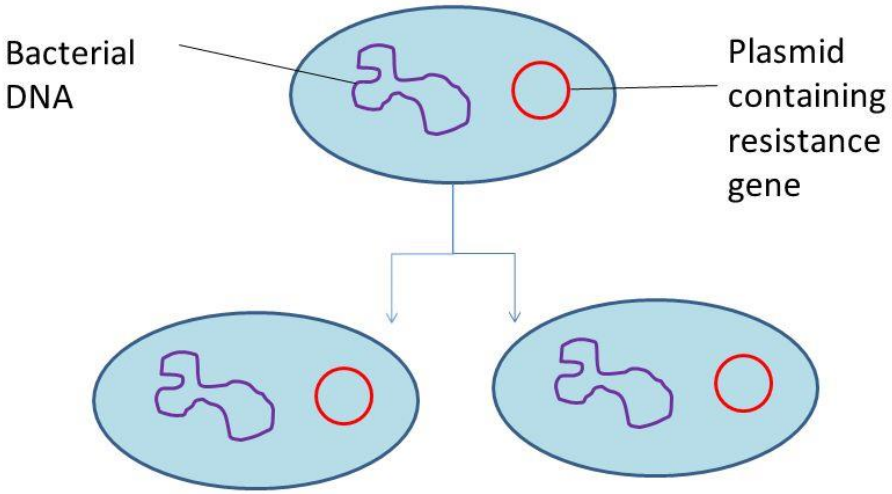
Bacteria can spread antibiotic resistance genes using:

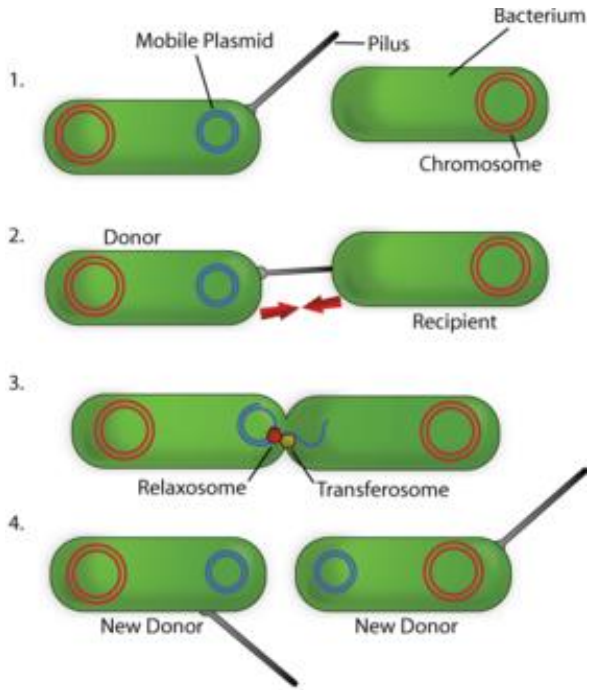
- **Vertical transmission**

→ pass plasmids down to daughter cells by binary fission

- **Horizontal transmission**

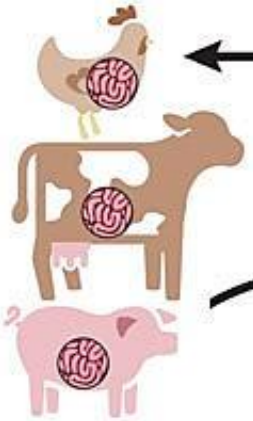
→ pass plasmids to other bacteria by conjugation



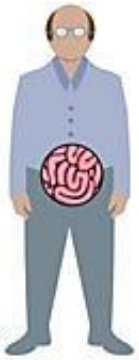


Examples of How Antibiotic Resistance Spreads

Animals get antibiotics and develop resistant bacteria in their guts.



George gets antibiotics and develops resistant bacteria in his gut.



Drug-resistant bacteria can remain on meat from animals. When not handled or cooked properly, the bacteria can spread to humans.

George stays at home and in the general community. Spreads resistant bacteria.

George gets care at a hospital, nursing home or other inpatient care facility.

Fertilizer or water containing animal feces and drug-resistant bacteria is used on food crops.

Resistant germs spread directly to other patients or indirectly on unclean hands of healthcare providers.

Healthcare Facility

Vegetable Farm

Drug-resistant bacteria in the animal feces can remain on crops and be eaten. These bacteria can remain in the human gut.

Patients go home.

Resistant bacteria spread to other patients from surfaces within the healthcare facility.

Simply using antibiotics creates resistance. These drugs should only be used to treat infections.

Updated on 12/10/21 by Beh SJ @behlogy

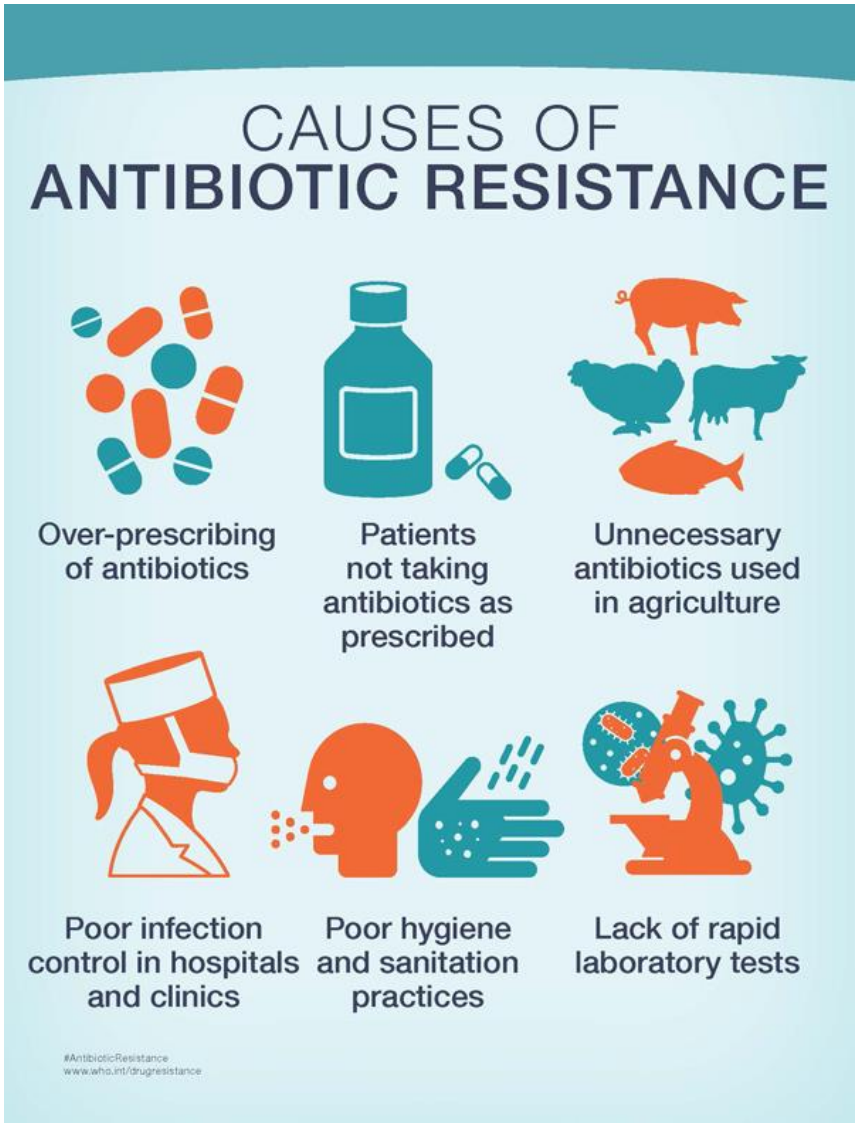
Antibiotic Resistance

Cause:

- Due to patients **not completing the course of antibiotics given**

→ Treatment may not be completed so some susceptible bacteria survives

→ Bacteria replicates and have increased chance of mutation / becoming resistant



Antibiotic Resistance

Consequences:

- Bacteria can carry several antibiotic resistance genes
- Develop **multiple resistance**
- Become a “super bug”
- E.g. methicillin-resistant *Staphylococcus areus* (MRSA)

→ Wounds do not heal and are continually infected with bacteria

- Cannot be killed/inhibited by common antibiotics
- **Need to be controlled by stronger antibiotics**

→ But we are running out of antibiotics!

Antibiotic Resistance

Solution:

- We need to discover more **new antibiotics**
- We can slightly alter/modify chemical structure of known antibiotics to produce new antibiotic
- BUT discovery takes time!

- The best solution is…. **PREVENTION!**
- **Only use antibiotics when prescribe**
- **Always finish the course of antibiotics**

ANTIBIOTIC RESISTANCE
WHAT YOU CAN DO
HANDLE
ANTIBIOTICS
WITH CARE
Antibiotic resistance happens when bacteria change and become resistant to the antibiotics used to treat the infections they cause.
1 Only use antibiotics when prescribed by a certified health professional
2 Always take the full prescription, even if you feel better
3 Never use left over antibiotics
4 Never share antibiotics with others
5 Prevent infections by regularly washing your hands, avoiding contact with sick people and keeping your vaccinations up to date
www.who.int/drugresistance
#AntibioticResistance
World Health Organization

Chapter Outline

- What is an **infectious disease**? What are **pathogens**?

- Causes, Transmission, Symptoms, Treatment, Prevention and Global Distribution of:

1. **Cholera**
2. **Malaria**
3. **HIV/AIDS**
4. **Tuberculosis**
5. **Smallpox** (just the causative agent)

- **Antibiotics**
  e.g. Penicillin
  Why it doesn't it work on viruses?
- **Antibiotic Resistance** (Cause + Consequence + Prevention)

Links

- If you are obsessed with colourful maps showing global distribution…

http://www.who.int/gho/map_gallery/en/

- Antibiotic resistance

http://time.com/4767683/bacteria-antibiotic-resistance-superbugs/

- Malaria Lifecycle

https://www.youtube.com/watch?v=1v55yg0RfoY